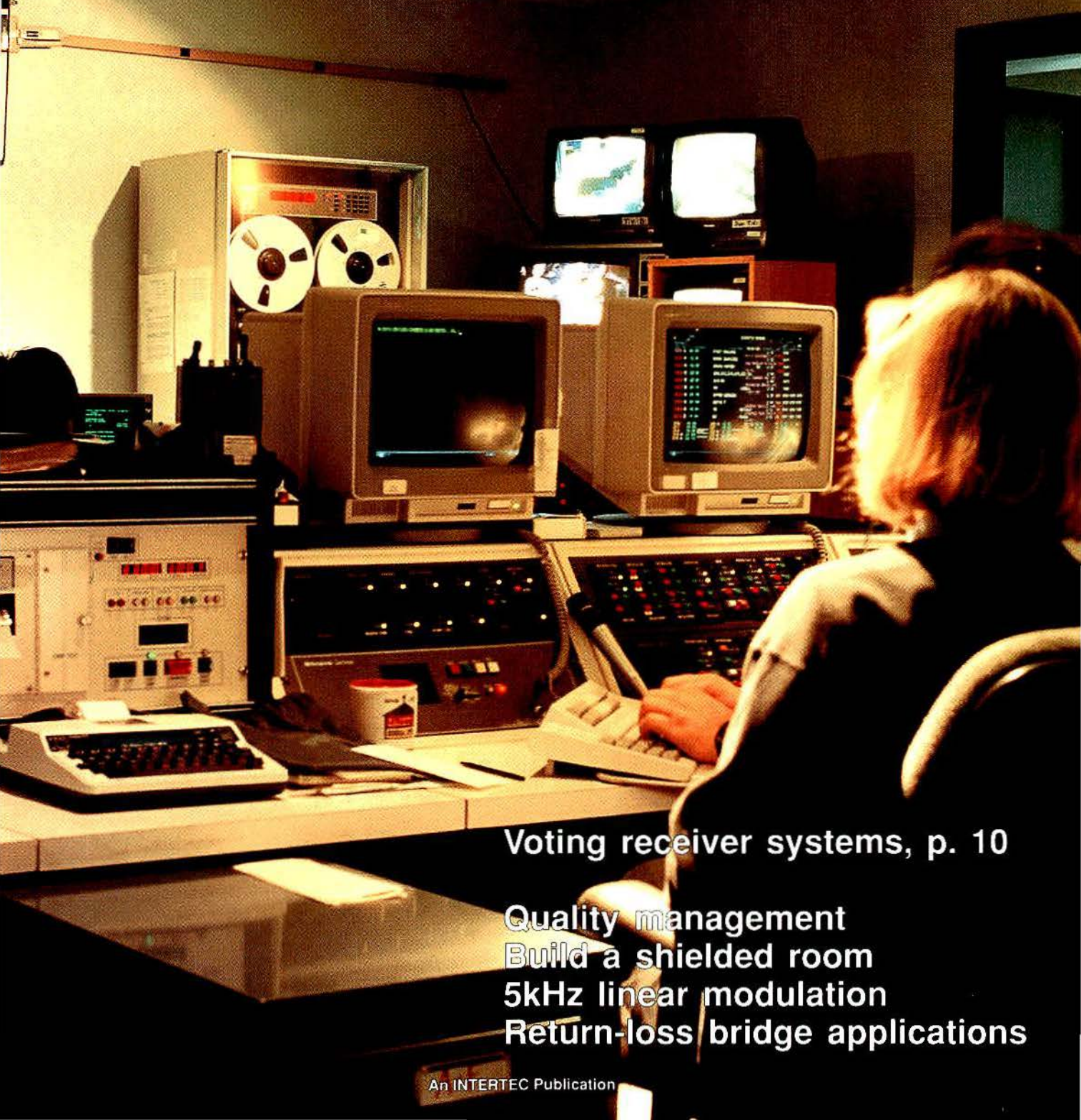


January 1994/\$3.00

Mobile Radio Technology™

The journal of mobile communications technology

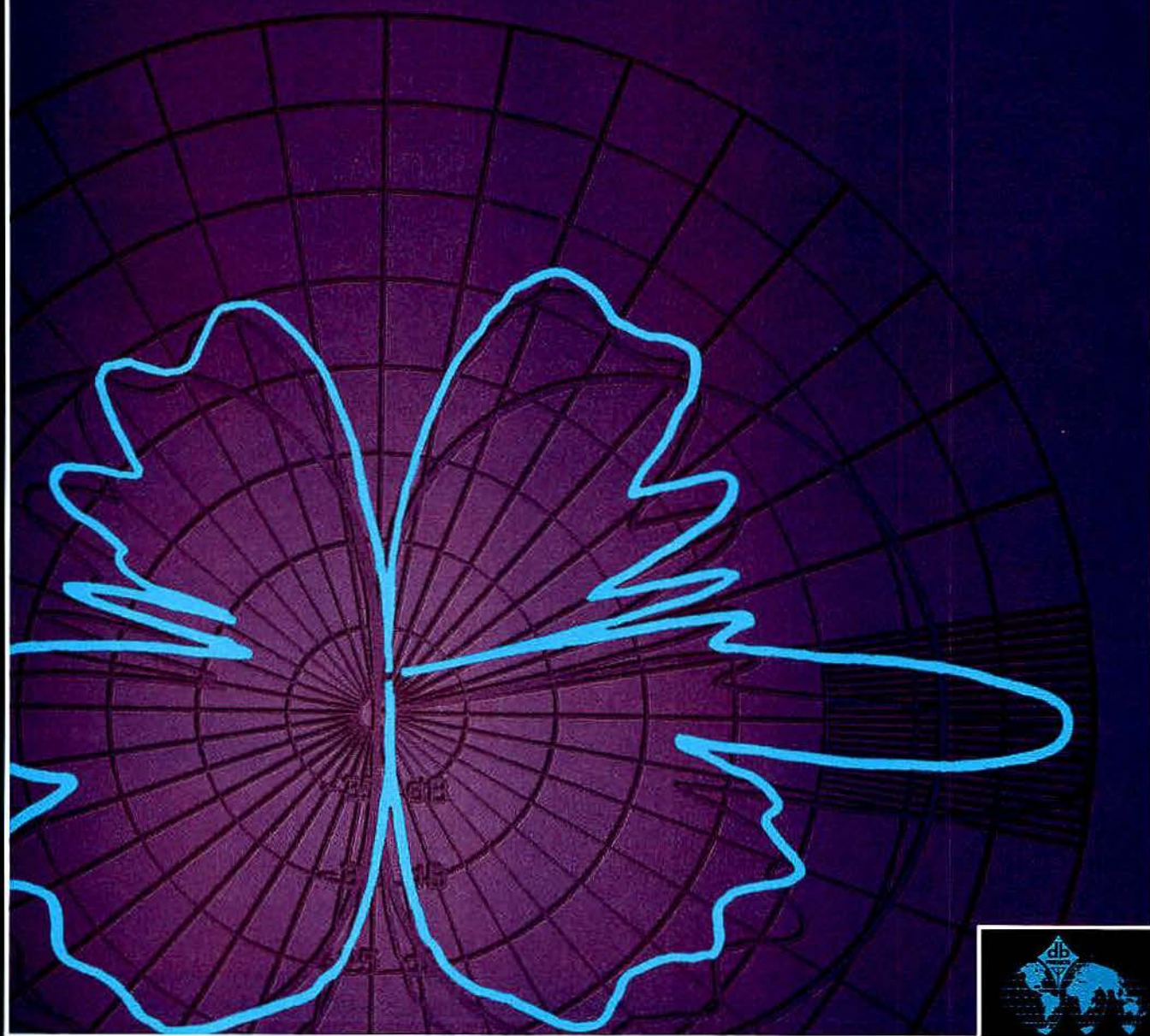


Voting receiver systems, p. 10

Quality management
Build a shielded room
5kHz linear modulation
Return-loss bridge applications

An INTERTEC Publication

At Decibel,
We Pattern Our Business
After Yours.



Base Station Antennas For Any Application.

At Decibel Products, our business is base station antennas. That's why we're the source for an unparalleled breadth and depth of quality antennas patterned for your radio frequency business. Whether you provide cellular/GSM, land mobile, paging, air-to-ground, PCN/PCS, or any other wireless network, we have the antennas to produce patterns that precisely fit your applications.

So call Decibel's systems engineering department today at 1-800-676-5342 for expert assistance with your unique base station antenna applications needs. And follow a pattern of excellence for your business.



P.O. Box 569610
Dallas, Texas 75356-9610
Order Hotline 1-800-676-5342
Order FAX 1-800-229-4706
214-631-0310
FAX 214-631-4706

Your Wireless Connection.™

The 10-site radio controller



Gooseneck
microphone
optional

Clock/audio-level/
cross-mute display
optional

Vega's C-5111 10-line/4-frequency console

Vega's Model C-5111 compact, easily rack-mounted, ten-line/four-frequency radio control console provides instant PTT, timed mute, and other most-needed features. This tone-format console allows you to quickly select one or any combination of up to 10 remote base stations. A second speaker allows you to monitor (with individual volume controls) any combination of those 10 stations that are not already selected for TX/RX control. Instant PTT switches allow immediate response to a call on a particular "selected" or "unselected" line, without disturbing the programming of the "selected" simulcast group or line.

Standard features available on the cost-effective and versatile C-5111 console include:

- **SELECTED switches** for selecting any combination of lines for transmitting and receiving
- **UNSELECTED switches** for monitoring any combination of unselected lines

- **TX ALL (simulcast) switch** for selecting all lines for both transmit and receive
- **RX ALL switch** for monitoring all unselected lines
- **Separate speakers and volume controls** for "selected" (TX/RX) and "unselected" (RX-only) audio
- **GROUP SELECT switch** for easy selection of TX/RX line combinations
- **TIMED MUTE switch** to mute "unselected" audio temporarily
- **Separate volume controls** for each "unselected" line
- **Instant-PTT switches** for each line
- **Line-activity LEDs** (function on all lines, selected or not)
- **Heavy-duty 120/240-V_{ac} power supply** (also runs on 12 V_{dc})

Options

- **DCA-3 external three-line adapter** for DC-format lines

- Gooseneck and desk microphones, headsets, footswitch
- DTMF pad
- Cross mute
- Clock, audio-level bargraph, and cross-mute indicators
- Rack-mount kit

The C-5111 has the flexibility to accommodate most any multiline console requirement. Call 1-800-877-1771 (toll-free) now for full details on the C-5111 console.



a **MARK IV** company
Signaling Products Group

9900 East Baldwin Place
El Monte, California 91731-2294
Telephone: (818) 442-0782
Toll-Free Telephone: 800-877-1771
Fax: (818) 444-1342
FaxBack: (818) 444-2017
Toll-Free FaxBack: 800-274-2017

Circle (4) on Fast Fact Card

features

10 Controlling voting receiver systems

David R. Groen, P.E.

Voting receiver systems can be a challenge to control. A remote comparator display makes the job much easier by giving the dispatcher and the technicians real-time comparator status information.

22 Servicing pagers: Build a shielded room

David Ludvigson

Part 1—A do-it-yourself shielded room helps to isolate a signal generator from nearby paging transmitter signals while troubleshooting pagers. Here are some suggestions for building your own.

28 Quality management for service facilities

Donald D. Koehler

Part 1—The type of maintenance management you practice helps to determine the kind of data you can gather to use in making decisions. The data are best gathered via an analysis of local conditions.

34 Technology update: 5kHz linear modulation

M.R.J. Bayly, C.Eng

With the ever-increasing demand for radio spectrum, linear modulation offers a real solution for users and regulators and surprising performance. The 220MHz users will be first to enjoy the advantages; others will follow.

departments

4 Editorial

Scanning...

6 Calendar

8 Technically speaking

Harold Kinley, CET
The return-loss bridge and its applications.

47 News

NABER calls for 1994 Technician-of-the-Year nominations.

50 Regulating Technology

Robert H. Schwaninger Jr.
Calling all cars!

52 New products

Telex, IWL Communications and Ericsson GE are the "Readers' Choice."

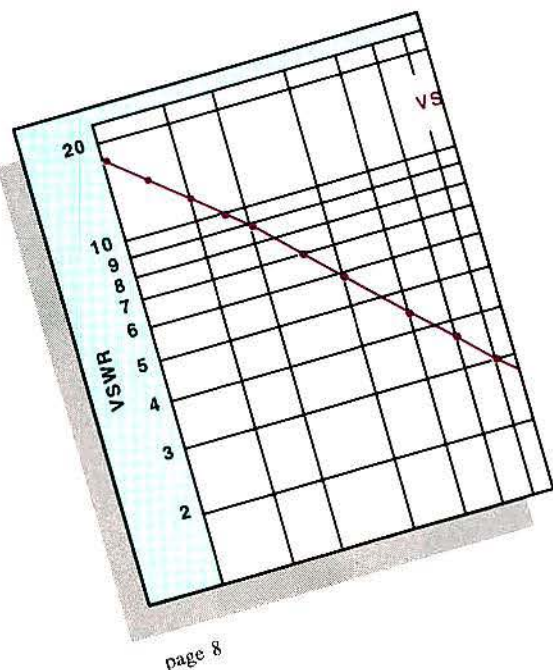
58 Literature

59 People

60 Classified ads

80 Ad index/hot line

Find advertisers quickly.



page 8



page 22

On the cover: The dispatch center at the Overland Park, KS, Justice Center.

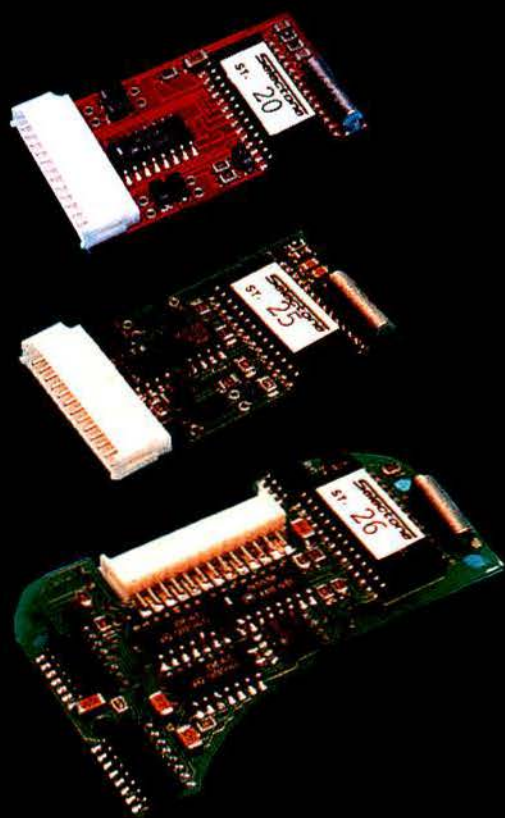
Mobile Radio Technology (ISSN 0745-7626) is published monthly for free to qualified individuals by Intertec Publishing Corporation, 9800 Metcalf, Overland Park, KS 66212-2215. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address change to MOBILE RADIO TECHNOLOGY, P.O. Box 12960, Overland Park, KS 66282-2960.

New Enhanced
ST-25A
(Call for details).



THE PRIVATE COLLECTION

AFFORDABLE VOICE ENCRYPTION



Anyone—eavesdroppers, competitors, news media or common criminals—has access to most two-way radio communications. That's why Selectone's new line of voice encryption modules are such a vital component in any mobile radio system. And our "Private Collection" of compact encryption devices doesn't represent a big investment on your part. Depending on the level of security required, Selectone offers two encryption types: basic 8-code speech inversion, or a proprietary, digitally-controlled rolling code system with over 4 billion code keys.

- **ST-20 INVERSION SCRAMBLER** is our lowest cost system. Measuring only 1.5" L x 0.85" W x 0.25" H, it fits easily in any radio and is virtually transparent to the end user.
- **ST-25 MOBILECALL® ENCRYPTION MODULE** is a digitally-controlled, high security module that can be field programmed (with ST-905 Programmer) to provide over 4 billion code keys. It is the same size as ST-20 and is compatible with most radios including the new Radius® GP300.
- **ST-26 MOBILECALL® ENCRYPTION MODULE** (for p200/HT600) is similar to and fully compatible with ST-25. It is especially configured as a kit for the popular Radius® p200 and Motorola HT600 and MT1000 portable transceivers.

* Radius and Motorola are registered trademarks of Motorola, Inc.; Mobilecall is a registered trademark of Selectone Corporation.

PHONE FOR FULL FACTS - 1-800-227-0376

SELECTONE CORPORATION
23278 Bernhardt Street, Hayward, California 94545
PHONE: (510) 887-1950 FAX: (510) 887-4011
IN CANADA: EASTCOM INDUSTRIES (416) 850-2550

Circle (5) on Fast Fact Card

Selectone

Scanning . . .



Billions and billions

A billion dollars here, a billion dollars there—all in a day's work for Nextel Communications, Rutherford, NJ; Dial Page, Greenville, SC; and CenCall Communications, Denver.

They make it look so easy.

Still, the numbers are enormous.

Nextel is ready to buy 2,500 specialized mobile radio (SMR) channels from Motorola, Schaumburg, IL, for \$1.8 billion in stock. In October, Nextel agreed to spend \$1.18 billion in stock for other dispatch properties.

Dial Page and CenCall are ready to buy other Motorola systems for \$1.2 billion worth of their stock.

Stock value makes a big difference in these transactions. Let's look at some numbers.

On Nov. 8, before Nextel announced its purchase of Motorola SMR channels, its stock was trading at \$46, off from its highest price of \$55. (Its lowest trading value during the past year was \$15.)

A week after the announcement, the stock had fallen to \$35.88. Why? Some say it is because at \$1.8 billion, the Motorola channels had been valued at six times revenue. Previous Nextel purchases, it is said, were valued at as much as nine times revenue. Thus, the Motorola purchase set a lower benchmark value for SMR channels, depressing the stock.

Others say the Nextel stock value fell because the apparent level of competition increased when financier George Soros and Vanguard Cellular invested in Geotek Industries, New York. Geotek, an SMR operator with a digital technology that it says will rival Nextel's, has been acquiring channels to offer competitive service.

Financial analysts suggest that as much as \$10 billion may be required to build the Nextel-Dial Page-CenCall nationwide network, leaving much cash yet to be raised.

Executives at the companies say they are optimistic. Perhaps they will even make it look easy.

* * *

Beep that server

Having trouble getting a waiter's attention? Call your server on a pager.

As the number of paging service subscribers continues to grow at an annual rate of 20%, it is inevitable that the service will find its way into every possible market—and now we're talking restaurants.

ServiceAlert, Boulder, CO, and Motorola's Customer Owned Paging Op-

eration in Boynton Beach, FL, have teamed to offer a system whereby restaurant patrons silently page their servers. Pressing a button built into a sugar, salt and pepper caddy causes the server's pager to vibrate and to display the number of the table originating the call.

"As focused on patron satisfaction as a server may be," said Leonard Schlesinger, "he or she is not a mind reader. The paging system provides a 'fail safe' system to ensure that the customer is heard." Schlesinger previously was chief operating officer of Au Bon Pain, a French bakery chain. He now is a professor of business administration specializing in service management at Harvard Business School.

Check, please.

* * *

Battery recycling

Not long ago in this column we congratulated Multiplier Industries, Mt. Kisco, NY, for offering nickel-cadmium (NiCd) battery recycling to its customers.

Cadmium is widely recognized as a toxic substance that should not be placed in landfills where it can migrate to ground water. Yet without an adequate recycling program, many NiCd batteries are discarded as waste destined for landfills.

Nickel has its own toxic effects, too, some manufacturers have told us, although the need to recycle nickel has not received as much attention as cadmium.

The Portable Rechargeable Battery Association (PRBA) is taking steps to help NiCd battery manufacturers to recycle.

For example, the association may provide retailers with corrugated boxes to serve as collection and shipping cartons. The cartons would include prepaid United Parcel Service shipping labels to make it simple for retailers to participate. Display signs, safety instructions and plastic bags would be included with the cartons.

Where NiCd batteries are used in large quantities, the association may provide collection and shipping services.

PRBA may form an organization to run the recycling program so participants do not have to devote employee time to partake in the recycling program.

Recycling NiCd batteries is a good idea, and we'll be first in line with some spent batteries we've kept in storage, waiting for a better place to dispose of them than the trash bin.

—Don Bishop

TRANSCRIPT COMMUNICATION SECURITY...

THERE IS NO EQUAL.

Because communication security is critical, you choose Transcript. When it comes to top performance, versatility, experience and unmatched value, there is no equal to Transcript.

We've been designing innovative communication systems for public agencies for over 15 years. Our communication security equipment has proven itself in over 1000 different radio models in thousands of systems in more than 70 countries. Transcript equipment is the approved standard for law enforcement and government agencies worldwide.

But don't take our word for it. Call anyone with secure communications.

Or call us. We'll give you a list of customers who choose Transcript.

They'll be happy to tell you why.



TRANSCRIPT INTERNATIONAL.
THERE IS NO EQUAL.

CALL 1-800-228-0226.

AGENCY AGENCY
U OF NARCOTICS
CITY OF CARLSBAD
TRANSBAY COUNTY PATROL
ROYAL HONG KONG POLICE FORCE
WARNER BROTHERS
U.S. ARMY
DELAWARE STATE POLICE
PLACER COUNTY SHERIFF'S OFFICE
YALE UNIVERSITY
LOS ANGELES POLICE DEPARTMENT
UNITED STATES FOREST SERVICE
OREGON STATE POLICE
CITY OF QUEBEC
LONDON METROPOLITAN POLICE
STATE OF IOWA
SHELL OIL
CALIFORNIA NATIONAL GUARD
HENNEPIN COUNTY SHERIFF'S DEPARTMENT
CANTON REGIONAL TRANSIT AUTHORITY
ARIZONA DEPARTMENT OF PUBLIC SAFETY
FEDERAL BUREAU OF LAND MANAGEMENT
SWEDISH BOARD OF CUSTOMS
FAIRFAX COUNTY PUBLIC SCHOOL SYSTEM
NAVAL AIR WARFARE CENTER
GLOBAL WULFSBERG
CITY OF MONTREAL
YELLOWSTONE NATIONAL PARK
PORTUGUESE CUSTOMS
STATE OF VERMONT
POLICE CO

TRANSCRIPT
INTERNATIONAL

THE WORLD LEADER IN VOICE PRIVACY AND SIGNALING TECHNOLOGY

1620 North 20th Street, Lincoln, NE 68503, (402) 435-4400, FAX (402) 435-6780

1994

February

7-8—AMTEX, the American Mobile Telecommunications Association's Marketing and Technology Conference and Exposition, Marriott on International Drive, Orlando, FL. Contact: 202-331-7773.

March

2-4—Cellular Telecommunications Industry Association Winter Meeting and Exposition, San Diego. Contact: 202-785-0081.
6-9—Energy Telecommunications and Electrical Association, Henry B. Gonzales Convention Center, San Antonio. Contact: 214-235-0655.

April

13-15—International Wireless Communications Expo/Spring, Las Vegas Convention Center, Las Vegas. Contact: 303-220-0600.

May

2-5—Supercomm, sponsored by USTA and TIA, and International Conference on Communications, sponsored by IEEE, New Orleans. Contact: USTA, 202-835-3100.
12-14—Mobile Communications Conference, sponsored by the National Association of Business and Educational Radio (NABER), Peabody Hotel, Orlando, FL. Contact: Nancy Palleschi, 800-759-0300.
25-27—RadioComm, Vancouver Convention Center, Vancouver, British Columbia. Contact: Bill Eggertson, 613-233-4888.

June

7-11—Vehicular Technology Conference, sponsored by IEEE Vehicular Technology Society, Stockholm, Sweden. Contact: Professor Sven-Olof Ohrvik, technical chairman, 46 8 757 0483; Fax 46 8 34 8441.
18-20—International Public Safety Exposition and Conference, sponsored by the International Association for Public Safety, Dallas Convention Center, Dallas. Contact: 203-847-9679.

18-23—Utilities Telecommunications Council, Washington Sheraton, Washington, DC. Contact: Rita Clark, 301-621-7802.

July

17-20—Forestry-Conservation Communications Association, Hershey, PA. Contact: Don Pfohl, 602-644-3166.

August

6-11—International Municipal Signal Association, Cavanaugh's Inn, Spokane, WA. Contact: Harold Glerum, 800-723-4672.
7-12—Associated Public-Safety Communications Officers National Conference, Lawrence Convention Center, Pittsburgh. Contact: 800-824-1850.

September

22-24—Mobile Communications Marketplace, Washington State Convention Center, Seattle. Contact: 800-326-8638.

October

3-5—WirelessWorld Conference & Exhibition, sponsored by Cellular Business magazine, The Stouffer Orlando Resort, Orlando, FL. Contact: Stephanie Hanaway, 913-967-1856.
15-20—International Association of Chiefs of Police, Albuquerque Convention Center, Albuquerque, NM. Contact: 703-243-6500.
19-21—International Wireless Communications Expo/Fall, Tampa Convention Center, Tampa, FL. Contact: 303-220-0600.

November

18—Radio Club of America, Communications Symposium, Annual Dinner and Awards Presentation, New York Athletic Club, New York. Contact: Ron Formella, 201-652-6811.



Mobile Radio Technology

The journal of mobile communications technology

EDITORIAL

Don Bishop, *Editorial Director*
David Keckler, *Senior Associate Editor*
Ellen Payne, *Associate Editor*
Maureen Brellenthin, *Associate Art Director*
Harold Kinley, *CET, Contributing Editor*
David Ludvigson, *Contributing Editor*

INDUSTRY CONSULTANT

Fred M. Link

REGULATORY CONSULTANT

Robert H. Schwaninger Jr., *Brown and Schwaninger, Washington, DC*

EDITORIAL ADVISORY BOARD

Gene A. Buzzi, *President, Omnicom Telecommunications Engineering, Tallahassee, FL*
R. James Evans, *East Lansing, MI*
Gary David Gray, *P.E., Chief Telecommunications Engineer, Orange County Communications, Orange, CA*
Frederick G. Griffin, *P.E., President, Frederick G. Griffin P.C., Lynchburg, VA*
Mary Kjørvestad, *Empire Mobile Communications, Houston*

Larry Kline, *Beachwood, OH*
S.R. McConoughey, *P.E., Mobile Communications Consulting, Gaithersburg, MD*
Art McDole, *Salinas, CA*
Stuart F. Meyer, *Land Mobile Consultant, Vienna, VA*
Herb Sachs, *Herb Sachs Consulting, Bowie, MD*
Leon Spencer, *Exxon Computing Services Company, Houston*
Dr. Gregory M. Stone, *Senior Associate; Booz, Allen & Hamilton, McLean, VA*
Raymond C. Trott, *P.E., President, Raymond C. Trott Consulting Engineers, Irving, TX*
William A. Wickline, *P.E., Mentor, OH*

CORRESPONDENCE: Editorial and advertising correspondence should be addressed to P.O. Box 12901, Overland Park, KS 66282-2901, 913-341-1300, fax: 913-967-1904.

MOBILE RADIO TECHNOLOGY provides technical information to dealers, community repeater operators, specialized mobile radio operators, conventional and cellular RCC and WCC, mobile radio equipment manufacturers, manufacturers' reps, distributors, engineering/consulting firms, national/state/local government, military agencies, public safety agencies, transportation companies, petroleum/energy products companies, public utilities and others allied to the field.

SUBSCRIPTIONS: MOBILE RADIO TECHNOLOGY is circulated without charge in the United States by name and title to personnel who are re-

sponsible for sales, operation or maintenance of mobile radio equipment. Non-qualified subscriptions in the United States are \$30 per year; in Canada, \$36 per year; and in other countries, \$40 per year. Foreign airmail optional at an additional \$65 per year. Single copies are \$3 plus postage and handling; back issues, \$5 postpaid. Adjustment necessitated by subscription termination at single copy rate. Allow six to eight weeks for change of address or for new subscription. Send subscription information to: P.O. Box 12968, Overland Park, KS 66282-2968.

PHOTOCOPY RIGHTS: Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by Intertec Publishing, provided that the base fee of US \$2.00 per copy, plus US \$00.00 per page is paid directly to Copyright Clearance Center, 27 Congress Street, SALEM, MA 01970, USA. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transaction Reporting Service is 0745-7626/1993 \$2.00 + \$00.00.



\$3.00 + 0.00

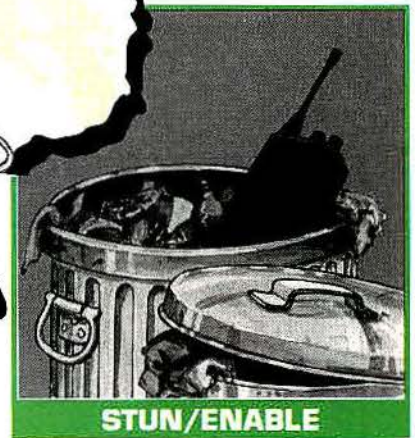
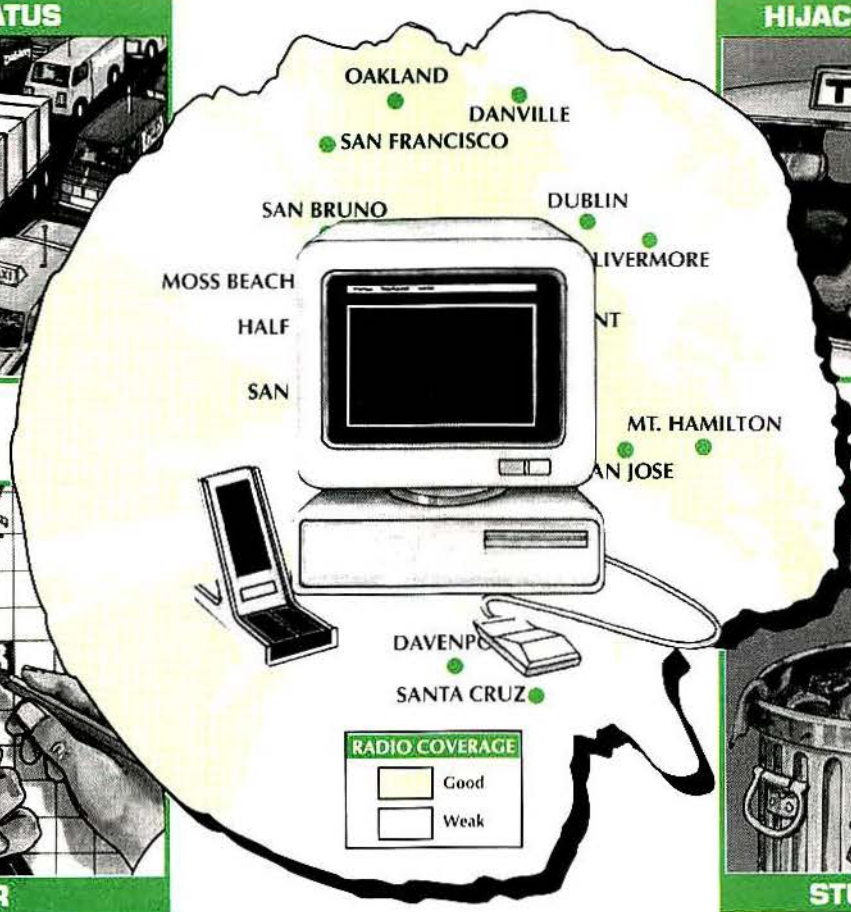
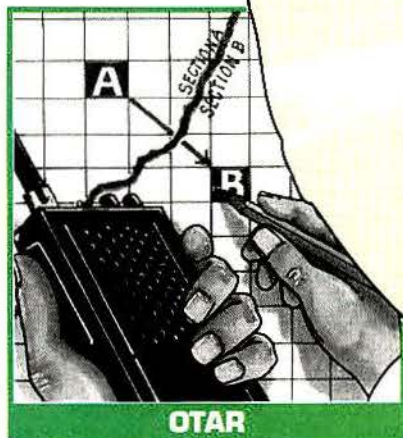
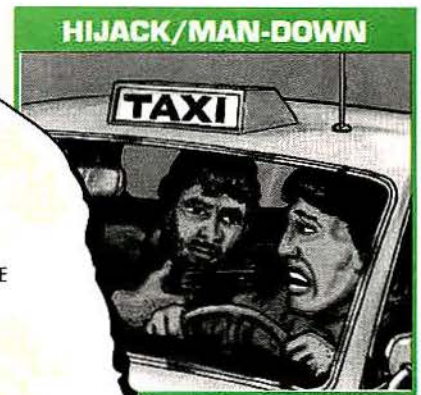
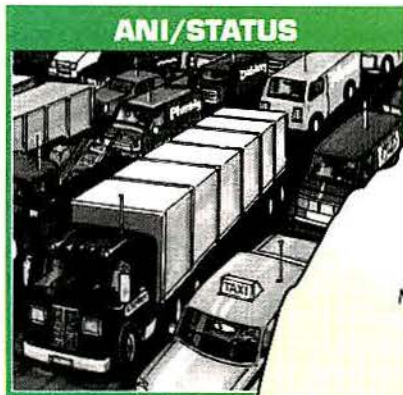
Audited circulation.



© 1994 by Intertec Publishing.
All rights reserved.

BIOFEEDBACK

FOR RADIO SYSTEMS
...because you never know when
a fleet unit is in a hole.



Map by Communications Engineering Technology, Inc.

CADiTM

COMPUTER AIDED DISPATCH

MX·COM, INC.

For better feedback from your dispatches, Call Toll Free: 1-800-638-5577

4800 Bethania Station Road, Winston-Salem, NC 27105-1201 • In North Carolina Call: (919) 744-5050 or FAX (919) 744-5054

Circle (7) on Fast Fact Card

The return-loss bridge and its applications



Photo 1. This return-loss bridge operates over the frequency range of 5MHz to 1,000MHz. This unit comes equipped with female N connectors. Photo courtesy of Eagle Wichita.

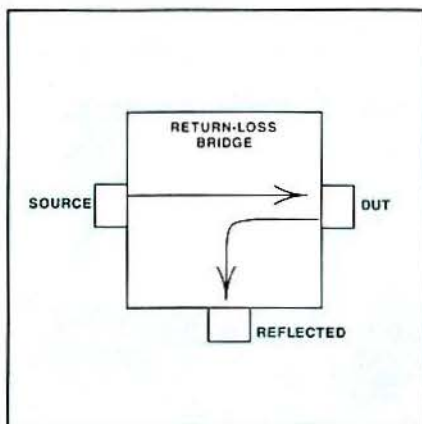


Figure 1. The return-loss bridge with a built-in reference termination has three ports: source, DUT and reflected. Any reflected power that enters the DUT port is transferred to the reflected port for measurement.

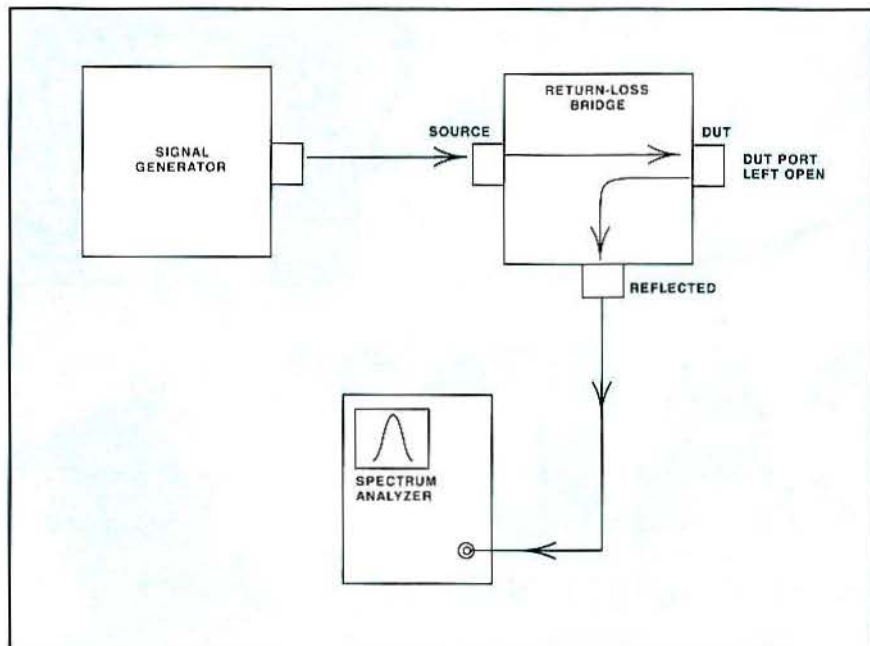


Figure 2. To measure the return loss of a device under test, it first is necessary to calibrate the spectrum analyzer to the 0dB reference level. The signal generator is set to the desired level, and, with the DUT port left open, the spectrum analyzer attenuator is adjusted to set the signal display to the 0dB line on the spectrum analyzer. It may be necessary to adjust the signal generator output level slightly to get the signal to the 0dB mark.

By Harold Kinley, CET

Return-loss bridges have many useful applications for the two-way radio technician.

Return-loss bridges are particularly helpful when used with the tracking generator feature of many service monitors.

A return-loss bridge may have a built-in reference termination, or it may require an external reference termination. The reference termination determines the system impedance. If the bridge is used in a 75Ω system, then the reference termination must be 75Ω. Similarly, a 50Ω system would require a 50Ω reference termination.

Some bridges have a built-in RF detector and provide a dc output from the measurement port. The return-loss bridge referenced in this column provides an RF output at the measurement port. Now, let's back up a moment and take a closer look at a typical return-loss bridge, as shown in Photo 1 above. This bridge is designed for use with 50Ω systems. It has a built-in 50Ω reference termination. There are three ports labeled as follows:

- (1) *Source* (sometimes called RF input port).
- (2) *DUT* or device under test (sometimes called load port).
- (3) *Reflected* (sometimes called RF output or measurement port).

Figure 1 to the left represents a typical return-loss bridge with an internal reference termination designed for a 50Ω system.

Theoretically, the loss from the source port to the load (DUT) port will be 6dB, and the loss between the DUT and the reflected port will be 6dB; therefore, if a 0dBm signal is applied to the source port with no load connected to the DUT port (open), the signal level at the reflected port will be 12dB below the level at the source port, or -12dBm.

Normally, when the return-loss bridge is used to make a measurement, the signal at the reflected port is used to calibrate or to set the 0dB reference level on the in-

(continued on page 40)

Kinley is a certified electronics technician with the South Carolina Forestry Commission, Spartanburg, SC. He is the author of *Standard Radio Communications Manual: With Instrumentation and Testing Techniques*. Prentice-Hall, 1985.

Save Your Batteries For When You Really Need Them.

Use X-Tra Talk, from Centurion.



Now you can make sure your batteries are ready when you need them.

It's simple. When operating from your vehicle, make it standard procedure to power

your two-way portable with X-Tra Talk (patent pending), the battery eliminator from Centurion.

X-Tra Talk plugs into your vehicle's lighter (or any other 12-volt source) to give you hassle-free operation for as long as you need to talk. No worries about power drain. No problems with related weakening of signal.

And best of all, no surprise battery failure down the line when you really need to use them.

Because X-Tra Talk gives you: • Maximum power output from your radio • Extended battery life • Protection against reverse polarity and current surges • Compatibility with virtually all popular two-way portables.

So why drain your radio's battery when you can tap into your vehicle's power source? Get X-Tra Talk and eliminate the frustration of batteries failing when you need them most.

X-Tra Talk. Another bright idea from Centurion, your two-way portable power source.

Call us toll-free at 800-228-4563 for the name of our distributor nearest you. And ask about our full line of batteries and power packs.



CENTURION INTERNATIONAL, INC.
Power When You Need It.

Controlling voting receiver systems

Voting receiver systems can be a challenge to control. A remote comparator display makes the job much easier by giving the dispatcher and technicians real-time comparator status information.

By David R. Groen, P.E.

Voting receiver systems provide enhanced coverage for wide-area systems.

In a voting system, receivers installed at multiple tower sites feed audio to a comparator or voter at a central site. The comparator selects the receiver with the best signal and sends that audio to the dispatcher.

Remote comparator displays

A remote comparator display provides the dispatcher or technician with real-time comparator status on a personal computer (PC) screen or console. (See Photo 1 below.)

The display helps the technician to diagnose and to repair voting system problems rapidly. Intermittent problems are easier to find because the dispatcher or technician can see which receiver is selected when the problem occurs.

A remote comparator display also allows the technician to disable and re-enable a receiver without making additional trips to the comparator location. This helps to verify system operation after a receiver or phone line is fixed.

Comparator problems

Although a well-designed voting receiver system brings many advantages to its users, its increased complexity makes it more difficult to control and to maintain

than a single-site system.

Noise, interference and phone line problems multiply because of the greater number of receivers. Audio levels and phone line frequency response become more critical as the comparator rapidly selects receiver sites with different phone line characteristics.

A malfunctioning comparator can cause audio drop-out or can select a noisy site instead of the best site. Improperly adjusted levels can cause misvoting. A faulty receiver, phone line or comparator module may cause the system to lock onto one site, making the system unusable for a time.

Most voting systems have receivers with overlapping coverage areas. This overlapping coverage allows graceful degradation when one or two receivers at a secondary site fail. Left unchecked, though, receiver failure leads to serious coverage problems when the receiver at a primary site fails.

Receiver failure problems are confusing and frustrating for the dispatcher and technician without a comparator display. System problems are much easier to diagnose and to correct if the comparator can be monitored and controlled readily by the dispatcher or technician.

The indicators and switches on a

Hamilton County Comm Center			
East Police	West Police	Central Police	Inquiry Police
Repeater	Repeater	Repeater	Repeater
Indian Hill Rx	Miami Heights	Williamson Rd	Comm Center
Williamson Rd Rx	Calhoun Hall	Greenhills	Indian Hill Dis
Glendale W.T.	Cheviot	Engineers	Miami Heights
Comm Center Rx	Comm Center	Glendale W.T.	Calhoun Hall
Loveland W.T. Rx	Mt. Echo Dis	Calhoun Hall	Greenhills
Sweetwine Rx	Miami WW	Comm Center	Loveland W.T.
Anderson Twp Vote	Greenhills	Central 7	Mt St Joseph
Greenhills Rx	Cleves		Sweetwine
Engineers	Fernald	Fire Channel #1	Miami WW
Milford Rx	Prov. Hosp.	Repeater Dis	Glendale W.T.
Marlemont	Mt St Joseph	Comm Center	Marlemont
Calhoun Hall Rx	Engineers	Indian Hill Rx	Milford
East 13	Miamitown	Miami Heights Rx	Cheviot
East 14	Harrison	Calhoun Hall	Cleves
East 15	West 15	Engineers Rx	Williamson Rd
		Fire 6	Prov. Hosp.
		Fire 7	Fernald Fail
			Mt. Echo
			Engineers
			Miamitown

Photo 1. This remote comparator display PC screen shows the comparator status on a personal computer. The Vote, Rx, Dis and Fail indications show receiver status. The mouse or keyboard can be used to force-vote or disable receivers. The PC operates over leased or dial-up phone lines.

Groen is director of engineering at Combined Technologies, Cincinnati. The remote comparator display described in this article is one of the company's products.

Quiz

The screen in Photo 1 shows three minor problems and one major problem. Can you find all four problems?

(See page 14 for the answer.)

The New STABILOCK® 4015 Radio Test Set Tests Great—Less Weight

Under
\$13K/3 Year
Warranty

Finally, a two-way radio tester that fits under a helicopter seat, weighs less than 20 lbs., provides all the capabilities you've dreamed of in one unit, and doesn't cost an arm and a leg.

The STABILOCK 4015 packs a lot of features in a compact design:

- ☐ spectrum analyzer with audio
- ☐ electroluminescent display for easy viewing night or day
- ☐ licensed CLEAR CHANNEL LTR® testing capability
- ☐ memory cards to load and run tests automatically, including all cellular formats
- ☐ digital storage oscilloscope
- ☐ internal battery

Lighten your two-way test load today—call for more information on the STABILOCK 4015:

1-800-225-5765 (in MA: 508-671-9700).

CLEAR CHANNEL LTR is a registered trademark of the EF Johnson Company. STABILOCK 4015 is a registered trademark of Schlumberger Technologies.

NEW OPTION



Ericsson GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

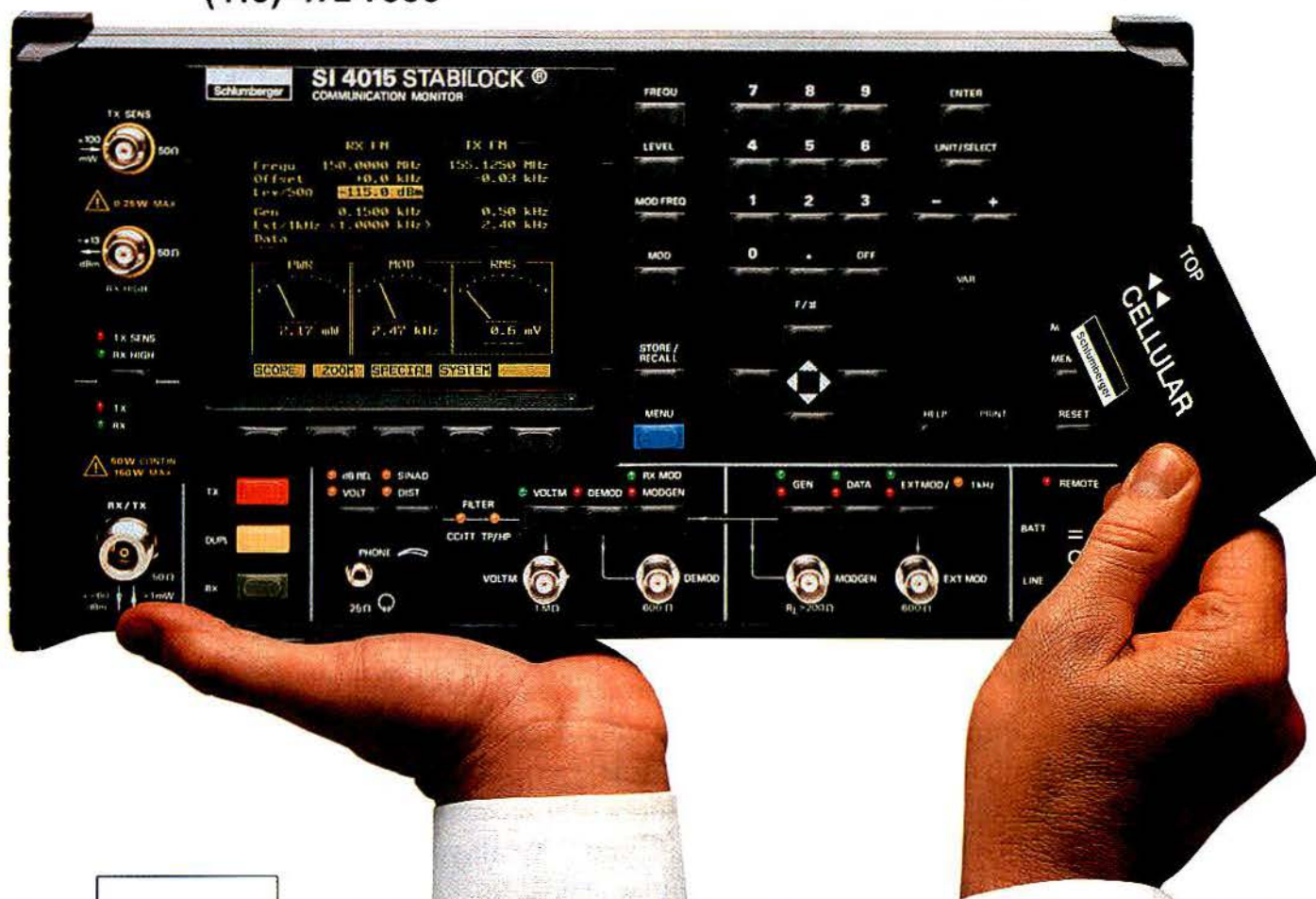
EDACS™

Trunking Licensee

**Now in stock at Tescos
(410) 472-7000**

**Quality Test Solutions
Schlumberger Technologies**

Schlumberger Instruments
P.O. Box 7004
829 Middlesex Turnpike
Billerica, MA 01821, USA
Phone-508-671-9700
Fax-508-671-9704
1-800-225-5765 (outside MA)



Schlumberger Technologies

Canadian Representative
Atelco Limited
9225 Leslie St. Unit 7
Richmond Hill, Ontario
L4B 3H6
Phone: 416-882-9455
Fax: 416-882-9454

Schlumberger Instruments
Victoria Road
Farnborough, Hampshire
GU14 7PW, England
Phone-44 252 376666
Fax-44 252 543854
Telex-858245

Schlumberger Instruments
50 Avenue Jean Jaurès
BP 620-06
F-92542 Montrouge Cedex, France
Phone-33 1 47 466700
Fax-33 1 47 466727
Telex-631468 ENERINS

Schlumberger Technologies GmbH
Gutenberg Str. 2-4
D-85 737 Ismaning
Germany
Phone-49 89996410
Fax-49 8999641160

Circle (9) on Fast Fact Card



Photo 2. Typical comparator indicators and switches include light-emitting diodes (LEDs) that show receiver status and switches that monitor (force-vote) or disable receivers.

comparator's front panel help to isolate voting system problems, but when a comparator is in an equipment room or at a remote site, the switches and indicators are not readily accessible to the dispatcher or technician. (See Photo 2 above.)

Service delays and intermittents

Inaccessible comparators delay system

problems can disappear before the technician gets to the comparator, only to reappear several hours after he has left the site.

When a system problem involves bad phone lines, a technician must re-enable the receiver and test the system when the telephone company service representative says the problem is fixed. This procedure

repairs because of extra travel time and service calls.

The technician first must visit the comparator location to analyze the situation and to disable the faulty receiver. Then another trip must be made to repair the receiver. After the repair is made, a third trip (back to the comparator) is required to place the receiver back in service.

Intermittent

wastes trips to the comparator and adds to the delays if the phone line has not *really* been fixed.

User advantages

Gloucester County, NJ, uses a remote comparator display at its console to monitor two comparator sites and 79 voting receivers.

Before the system was installed, a technician responding to service a receiver had to drive to the remote comparator site to determine which receiver was defective and to disable it.

According to James Flaherty, the county's director of communications, the remote comparator display has saved a tremendous amount of time. Now, the dispatcher can tell the technician which receiver is causing problems. The technician knows where to start without first making a trip to the comparator.

Also, the dispatcher can disable a non-critical receiver in the evening and have it repaired during normal work hours. This saves the county overtime pay for unnecessary after-hours calls.

The city of Chattanooga, TN, had an even bigger problem with comparator inaccessibility.

AMERICA'S MOST WANTED...

HUTTON CATALOGS ARE "HOT" COMMUNICATIONS TOOLS!

Hutton's Product Selection Guide belongs in the hands

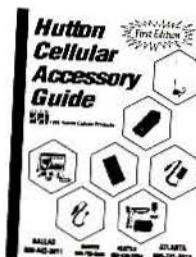


of the wireless communication professional. With over 6000 part numbers from 80 select manufacturers, this catalog is convenient in size and simple in content. With this easy-to-use catalog on hand you'll never have to look through stacks of catalogs again.

Hutton's Cellular Accessory Guide

was designed for the serious cellular carrier and agent. Helpful descriptions and pictures fill this catalog to assist you with all your cellular needs!

So don't miss out on these two helpful sales aids. Call us today to receive your **FREE** copies. You'll be glad you did!



DALLAS
800-442-3811

ATLANTA
800-741-3811

**COMM. WORKS
DENVER**
800-726-6245

**COMM. WORKS
SEATTLE**
800-426-2964

INTRODUCING...

CTCSS Trak™



CTCSS Trak™ is a breakthrough CTCSS decoding technology that gives our TP-154 the hottest CTCSS sensitivity and fastest decoding speed of any repeater tone panel in the business!

CTCSS Trak™ holds on tenaciously and does not talk down or false during the grueling industry standard FFOOOUUURRR test. Yet when a mobile unkeys **CTCSS Trak™** immediately closes the repeater squelch so unwanted background chatter is not heard in the mobile.

CTCSS Trak™ is now standard in every TP-154 and delivers a level of repeater performance that must be experienced to be believed.

CTCSS Trak™ firmware can be added to your existing TP-154's for only \$35.00 ea.

STANDARD FEATURES

- 50 CTCSS Tones
- 104 DCS Codes
- Supports 154 Subscribers
- Local and Remotely DTMF programmable
- DTMF-DTMF Regeneration
- Front Panel Display for Programming and DCS/CTCSS indication
- COS Input with polarity select
- Low Power Mode for solar powered sites
- Transponds all programming data to a CD-1 for programming verification
- E Trunk Compatible

PER USER PROGRAMMABLE FEATURES

- Hangtime
- Cross Tone and Code
- CW ID
- Courtesy beep
- Barge-in
- User Enable/Disable
- Reserve Tone
- Hog Penalty
- DCS/CTCSS during hangtime

SYSTEM PROGRAMMABLE FEATURES

- Programming Mode Access Code
- Activity Timer
- Kerchunking Filter Enable/Disable
- DCS Input Polarity
- DCS Output Polarity
- Repeater CW ID
- ID Speed
- COR or DCS/CTCSS Operate

CD-1 COMMUNICATIONS DECODER



The **CD-1** is a remote programming display for your TP-154. Every time you send up a command the TP-154 transponds the result to your **CD-1** display. Makes remote Programming as easy and positive as local programming.

The **CD-1** also decodes and displays 50 CTCSS tones, 104 DCS codes and DTMF when connected to your scanner or service monitor de-mod output. Useful for system monitoring and service work when not being used for remote programming.

Only **\$199**

- 60 Day return privilege • One year warranty



Connect Systems Inc.

2259 Portola Rd.
Ventura, CA. 93003

Toll free

(800) 545-1349

Phone (805) 642-7184

FAX (805) 642-7271

Call today to find out more about **CTCSS Trak™** and other product improvements. The TP-154 is still unbelievably priced at only... **\$299**

Circle (11) on Fast Fact Card

CSI is a registered trademark of Connect Systems Inc.

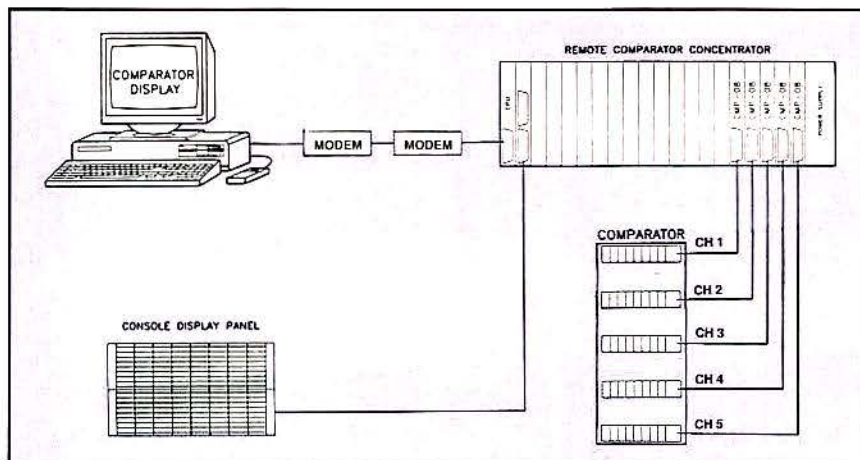


Figure 1. The remote comparator display system includes a remote comparator concentrator and a console panel or PC display. It extends the comparator indicators and switches using a serial data line. Displays can be connected directly or via leased-line, microwave or dial-up line.

The city's comparator is on a mountaintop. Ronald Farris, Chattanooga's electronics supervisor, explained that evening service calls are a serious problem. It takes his technicians 45 minutes to travel to the comparator from their homes. Intermittent problems have caused

many wasted service calls because the problems had disappeared before a technician reached the site.

Chattanooga's technicians now use a remote comparator display system. During the day, they use a PC at the radio shop to monitor the comparator. During

Quiz answer

The remote comparator display shown in Photo 1 shows the following problems:

1. The Mt. Echo receiver on the West Police channel is manually disabled.

2. The Fire Channel 1 repeater has been manually disabled.

3. The Fernald receiver on the Inquiry Police channel has failed.

4. This problem is tougher to see, but the dispatcher has a serious problem. The Fire Channel 1 comparator is not voting. It has three sites that are receiving, but none of them is voted. The dispatcher will not hear audio on this channel. Action: *Send a technician to service the comparator immediately.*

the evening, the on-call technician can check comparator operation from his home with a laptop PC and a dial-up modem. The remote comparator display improved the technicians' efficiency and reduced the number of wasted service calls.

You do not need a comparator at a mountaintop site to take advantage of a remote comparator display.

Hamilton County, OH, has seen the advantages, even though its comparators are only one floor away from the consoles.

The county's director of communications, M. J. Wesselmann, explained that before the remote comparator display was installed, dispatchers would walk downstairs to watch the comparator indicators in an attempt to direct the closest technician to a malfunctioning receiver site promptly.

Unfortunately, a manpower shortage made it difficult for the dispatchers to leave their positions for even a short period.

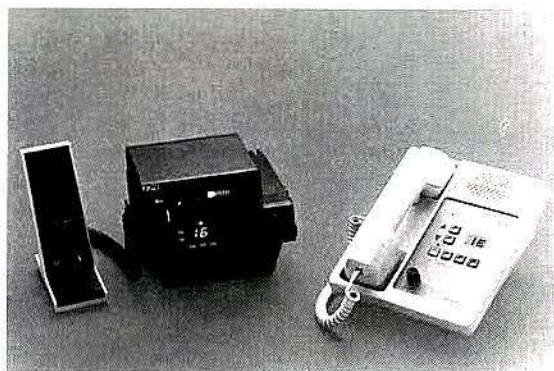
Hamilton County now has a remote comparator display at each dispatch and supervisor console. Dispatchers can tell the technicians which receiver has a problem without leaving their consoles.

Mobilcomm, the county's service contractor, has installed a PC remote comparator display at its shop. With the comparator display, technicians easily can monitor the system and find problems that otherwise would go undetected.

The Campbell County, WY, Sheriff's Department installed new voting receivers and a new CRT console.

The radio communications system has manual transmitter site selection, so the dispatchers need to see comparator status

GET CONTROL...



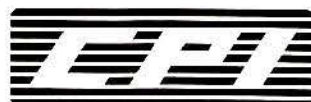
...Remote control, of upto 16 channels - Radius M200, GM300 & Maxtrac 300 series radios

The CPI model MCR210 remote and MCR series interface panel will allow you to remote control Radius or Maxtrac radios, upto sixteen channels, over any two wire voice grade circuit.

The MCR210 remote control system provides LED displays for remote channel indication, channel up and down buttons, PTT indicator, on-hook PTT capability, monitor button and indicator, intercom capability between parallel remotes and the radio, scan control button and indicator for those radios so equipped and speaker volume control.

Features

- Simple installation - No soldering, cutting or crimping
- Provides remote channel indication
- Does not require B308 option
- Remote transmissions heard over radio speaker
- Radio transmissions monitored on remote speaker
- Uses any two wire voice grade circuit



1186 Commerce Drive • Richardson, TX 75081
(214) 437-5320 • FAX (214) 437-5360 • (800) 869-9128

Circle (12) on Fast Fact Card

UltraLink Cable®

UltraLink 93605



The New Link For Your Base Stations

- Solid copper center conductor for excellent conductivity and lowest loss.
- Foam dielectric promotes low loss and prevents migration of water.
- 100% foil shield eliminates RF leakage and decreases the loss of the cable.
- 95% braid coverage for best connector attachment and excellent grounding.

UltraLink 93605 is the lowest loss RG213-size cable. 4.19 dB/100 feet at 900 MHz! Compare the loss of UltraLink Base 93605 cable with the others. For many applications it will be your preferred choice.

Order from the factory or your favorite distributor.

1-800-258-3860 • FAX: 1-800-258-3868

THE ANTENNA FARM
CANCOM COMPONENTS
CMC DISTRIBUTING
COMMUNICATIONS ASSOCIATES
COMMUNICATIONS WORKS
EASTCOM INDUSTRIES

ECONOMY TWO-WAY DIST.
ELECTRO-COMM
GRAHAM RADIO
HENRY RADIO
HUTTON COMMUNICATIONS
JAN INDUSTRIAL

PRIMUS ELECTRONICS
RF SERVICES
SANTA FE DISTRIBUTING
TALLEY ELECTRONICS
TECHNICAL EQUIPMENT DIST.
TESSCO INC.

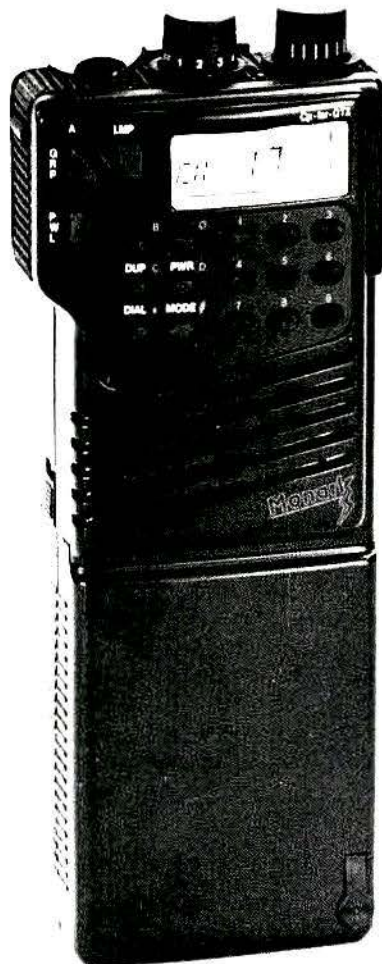
cushcraft/Signals

P.O. Box 4680, 48 Perimeter Road, Manchester, NH 03108 • 1-603-627-7877 • FAX: 1-603-627-1764

UHF-VHF SCAN-TRUNKING

PORTABLE TO TELEPHONE,
TELEPHONE TO PORTABLE and
PORTABLE TO PORTABLE CALLS

- Trunked and conventional mix
- No add-on trunking board
- 16 channels with 5 watts RF
- DTMF store & forward protocol



Monark QTX portable radio telephones handle the two most popular scan trunking formats and their many variations. Features include multi-group ROAM, single button * interconnect, remote controlled deadbeat disable with reset and easy inexpensive PC programming.

Available for immediate delivery!

Monark® International Corp.
© 1993 10735 NW Ambassador Dr.
Kansas City, MO 64153
Ph: 816-891-0700
Fax: 816-891-0888

Circle (14) on Fast Fact Card

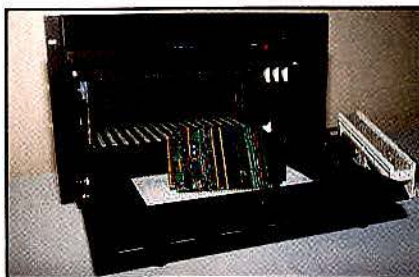


Photo 3. This close-up of a remote comparator concentrator shows the central processing unit (CPU) card on the left and comparator interface modules on the right. One of the comparator interface modules is shown below.

at the console to coordinate transmitter selection with the voted receiver.

According to Sharon Seieroe, the communications supervisor, there was not enough room on the CRT console to display the comparator information and the dispatch channels on the main screen. The dispatcher could not see which receivers

Console manufacturers usually require that the comparators be located close to the console remote electronics.

were selected without switching back and forth between screens.

Campbell County installed a remote comparator display that gives the dispatcher the ability to view comparator status on one CRT and the main dispatch screen information on another.

Comparator display methods

To provide comparator status indications to the dispatcher, some users have mounted the comparators near the console.

Others have extended the comparator indicators and switches using multiconductor cable and custom console panels. Still others use remote comparator interfaces from a console manufacturer. One enterprising user mounted a video camera on a pan and tilt mount directed toward the comparator rack.

Some of these methods work well for small systems but become unworkable for large systems. Considerations such as mounting space, aesthetics, multiple console displays, long cable distances or space

in a console's remote electronics cage may rule out some of these methods.

Console manufacturers usually require that the comparators be located close to the console remote electronics. An additional console remote electronics package is required if the comparator is located at a remote site.

None of these methods effectively addresses remote sites, multiple comparator sites, large systems or remote dial-up diagnostics. In many cases, there has been no practical way to bring comparator information to the dispatcher.

Remote comparator display

Figure 1 on page 14 shows one type of remote comparator display system.

It provides status indication and control for the voting system at a remote location. It works with a console display or a PC display.

The remote comparator concentrator multiplexes the comparator status indicators and sends them via a serial data stream to the operator display. It also passes multiplexed switch closures from the operator display back to the comparator.

The remote comparator display is not limited by multiconductor extension cables. It can be located in the same building, across town, or across the country—anywhere modems can be used.

The remote comparator display frees valuable "real estate" in the console re-

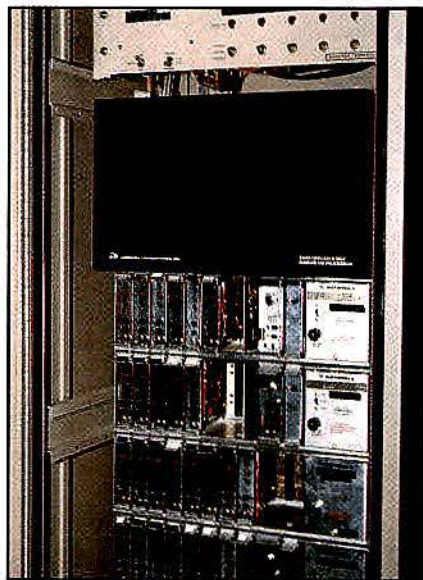
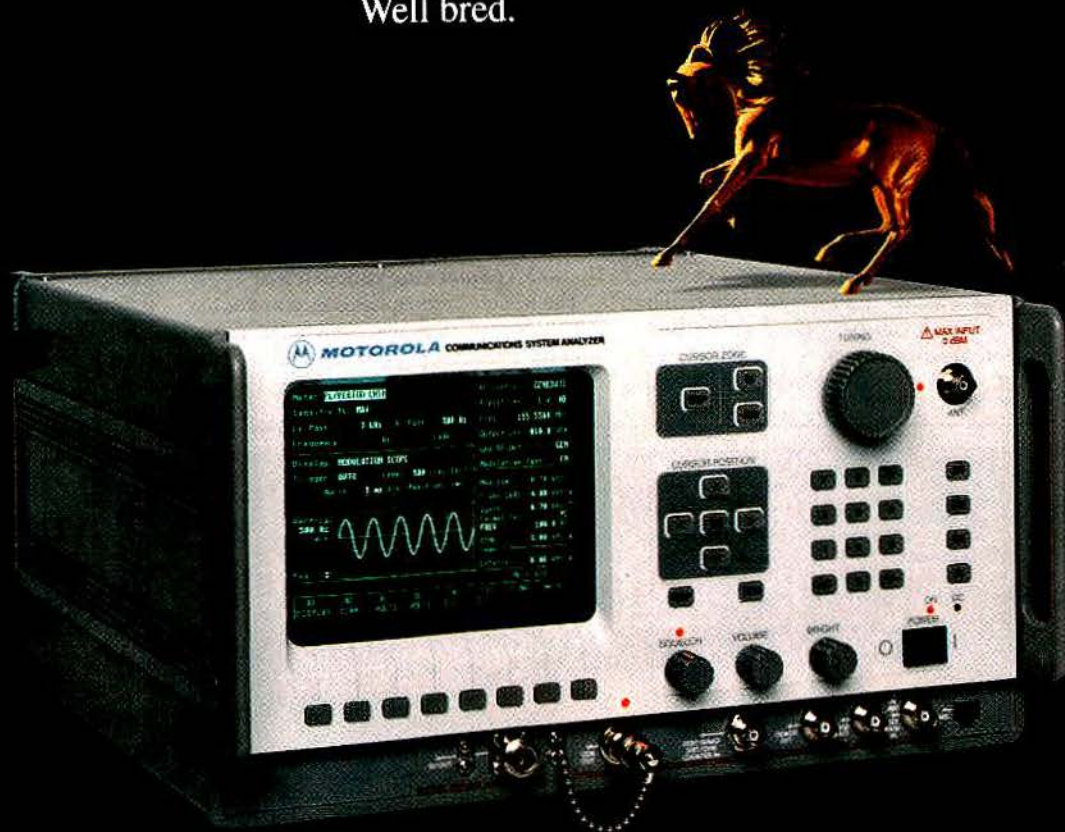


Photo 4. The Hamilton County, OH, communications center uses a remote comparator display to control 79 receivers on six channels. A remote comparator concentrator is shown with Motorola TAC (above) and Spectra-TAC (below) comparators.

*A Motorola
Thoroughbred.*

R-2600

The result of years of breeding by design and technical evolution. The Motorola R-2600 has the sleek quality of a thoroughbred and quick manners of a well trained quarterhorse. It knows what's needed with only a soft touch. The R-2600. Computerized, digital accuracy, analog feel. Dependable on the job. Well bred.



- AM / FM Signal Generator
- Duplex Offset Generator
- See & HearTM Spectrum Analyzer
- Off-the-Air Sensitivity Receiver
- Relative Signal Strength Meter
- Auto-Tune
- Terminated RF Wattmeter
- Tracking Generator (optional)
- Soft Keys and Windowing
- PL/PDL Encode/Decode
- SINAD Distortion Meter
- Oscilloscope
- Digital Voltmeter
- Frequency Counter
- Serial Printer Interface
- ...and More

*For Communications System Analyzer information:
Call 1-800-235-9590.*

The sculptured horse, "Magnificent Beast", is the work of George-Ann Tognoni, Phx., AZ.



MOTOROLA

Circle (15) on Fast Fact Card



Photo 5. The user can place receivers on a display screen by selecting a screen position and then picking a receiver from a list of receivers in the RIOP remote comparator concentrator. Note that one receiver position is dedicated for a REPEATER DISABLE.



Photo 6. Different display screens can be selected to watch different channels. Screens are selected from a list using pull-down menus.

mote card cage. It controls as many as 152 receivers in a 10.5-inch-high rack space.

Because the remote comparator concentrator is separate from the console remote electronics, it can be located at the comparator. It is unnecessary to add another set of console remote electronics to pro-

vide a comparator display.

Remote comparator concentrator

The remote comparator concentrator has a 20-slot card cage that houses the power supply, processor, communications and comparator interface boards. (See Photo 3

on page 16.)

With all 19 comparator interface boards installed, the remote comparator concentrator can monitor and control 152 receivers. A basic system includes one RS-232 communications port for the operator display. It can be expanded to 255 operator

First the cable, then the connector,



The Great Seal™ is the best environmental protection you can buy for cable connections. It shouldn't come as a surprise that you heard about it here first. As a Division of RFS, Inc., Celwave has been synonymous with innovations in transmission line products for years.

We introduced sequential cable markings, designed the self-flaring, double O-ring connector and perfected dielectric foam.

Now we've found a better way to put them all together.

Simply slip the Great Seal™ over a cable connection, pull out its plastic support coil and it instantly squeezes into a tight, form fitting sleeve that stops water migration cold. No heat shrinking, no taping, no blisters, no air pockets, no cutting, and it only takes about 3 minutes per connection. That can save you 45 minutes an hour hook-up time on every installation.

positions with parallel status and control.

Comparator connections

The comparators are connected to CMP-08 comparator interface boards. Each board controls as many as eight receivers and is available for Motorola TAC, Spectra-TAC and Digi-TAC; and Ericsson GE analog voters. (See Photo 4 on page 16.)

Installation consists of wiring to the indicator and switch lines on the comparator.

For example, the following signals are connected to the signal quality modules on a Motorola Spectra-TAC comparator: VOTE, UNSQUELCHED and FAIL light-emitting diodes (LEDs); the MONITOR (FORCE-VOTE) and DISABLE switches.

The MONITOR output from the remote comparator concentrator is momentary. The DISABLE output is latched.

DISABLE outputs can also be used for REPEATER DISABLES. Note that each of the channels shown in Photo 1 has REPEATER DISABLES configured. The "Fire" repeater is disabled.

Software configuration

After the system is installed, the system

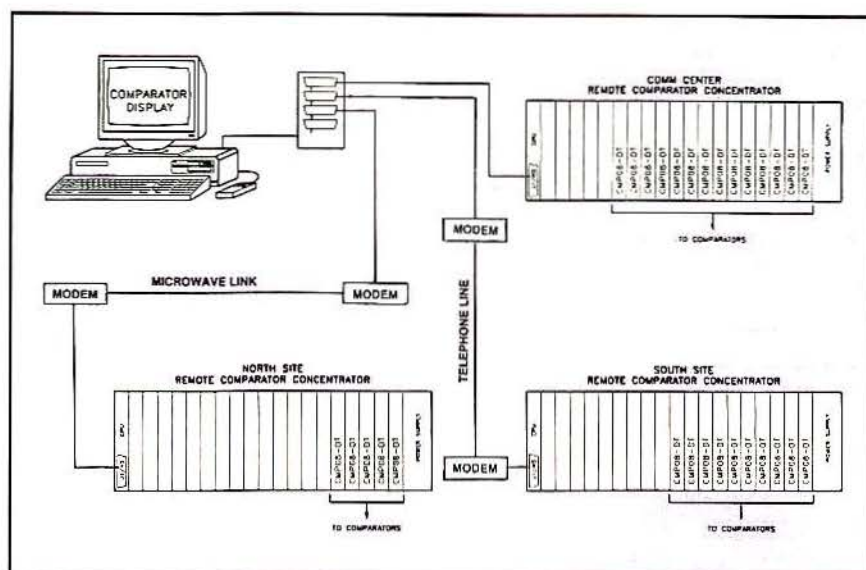


Figure 2. A four-port option allows the remote comparator display to control comparators at multiple locations. Each comparator location has a remote comparator concentrator. Remote sites use modems and phone lines or microwave channels to communicate to the PC display.

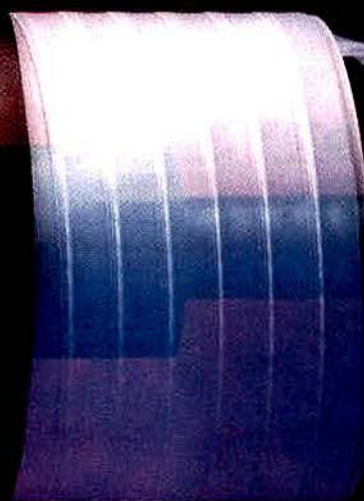
configuration program is run in the PC.

The user enters receiver and channel names for all the receivers and then builds screens for different display posi-

tions: e.g., police, fire, and emergency medical service.

Display screens are built by entering a screen name, adding channel titles and

now The Great Seal.™



Celwave has become the quality source for mobile telecommunications products worldwide. Our RF transmission line is available in air dielectric, foam and radiating styles from 1/4" to 3" in diameter. With innovative products like The Great Seal™ we insure your system's integrity from top to bottom and everywhere in between.

Let's talk about your future.

Celwave, 2 Ryan Rd., Marlboro, NJ 07746-1899

CELWAVE

DIVISION OF RADIO FREQUENCY SYSTEMS INC.

Circle (16) on Fast Fact Card



© 1993 Radio Frequency Systems, Inc.

placing receivers on the screen as shown in Photo 5 on page 18.

Program operation

Photo 1 shows the remote comparator display program in operation. Color-coded *Vote*, *Rx*, *Dis* and *Fail* status indications are displayed on the right of the receiver name. The left mouse button force-votes a receiver, and the right button disables a receiver.

A technician can use the keyboard to control the system with a laptop computer by highlighting a receiver with the cursor keys then pressing the *V* or *D* key to force-vote or to disable the receiver.

The system supports multiple display screens which are selected from a list as shown in Photo 6 on page 18.

Multiple comparator locations

The system supports multiple compara-

tor locations using a remote comparator concentrator at each comparator location and a multi-port adapter on the PC as shown in Figure 2 on page 19.

Display screens can include receivers from multiple remote comparator concentrators.

Additional advantages

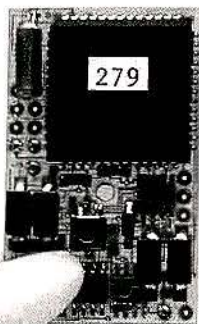
Hamilton County finds that comparator displays at their consoles help new dispatchers.

New dispatchers quickly get a feel for system performance, which helps them to understand the radio system better.

The dispatcher can determine the exact number of sites a mobile or portable radio signal is reaching. If he detects that a receiver is not working, he can call for service before multiple receivers fail.

Gloucester County wanted to add a receiver on a channel to cover a dead spot.

Caller ID: It will nail them.



Digital ANI

Caller ID will end the stuck mikes and stop the horseplay on your radios. ID-33 includes time-out timer and emergency. Fleet prices \$69 to \$121. 800-521-2203.



CSC CONTROL SIGNAL

1985 S. Depew, #7, Denver, CO 80227

Circle (17) on Fast Fact Card

The dispatcher can determine the exact number of sites a mobile or portable radio signal is reaching.

They used their remote comparator display to watch their county-wide channel to determine which site covered the area best. They were able to conduct the tests from the console instead of sending a technician to the remote comparator site.

A technician at the City of Chattanooga used the remote comparator display to help to track down a portable that was stuck in the on-the-air mode. The technician saved driving time because he was able to determine on which side of a mountain ridge the portable was located.

Conclusion

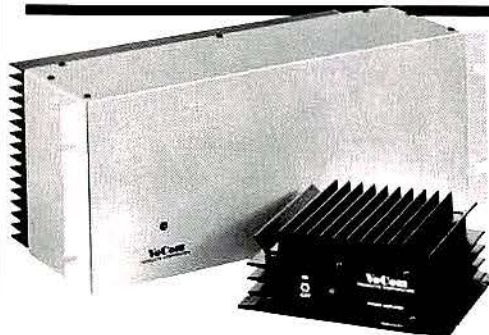
A remote comparator display is an effective tool for monitoring and controlling voting systems.

With a remote comparator display, a dispatcher or technician can diagnose voting system problems from the console, radio shop or from home.

The remote comparator display increases user safety by reducing receiver down-time. It lowers operating costs by reducing unnecessary service calls and increasing technician efficiency. The display offers better control of a voting system.



BIG or SMALL We Have It All!



VoCom / RF Corporation

Quality since 1979

1-800-USA-MADE

(1-800-872-6233)

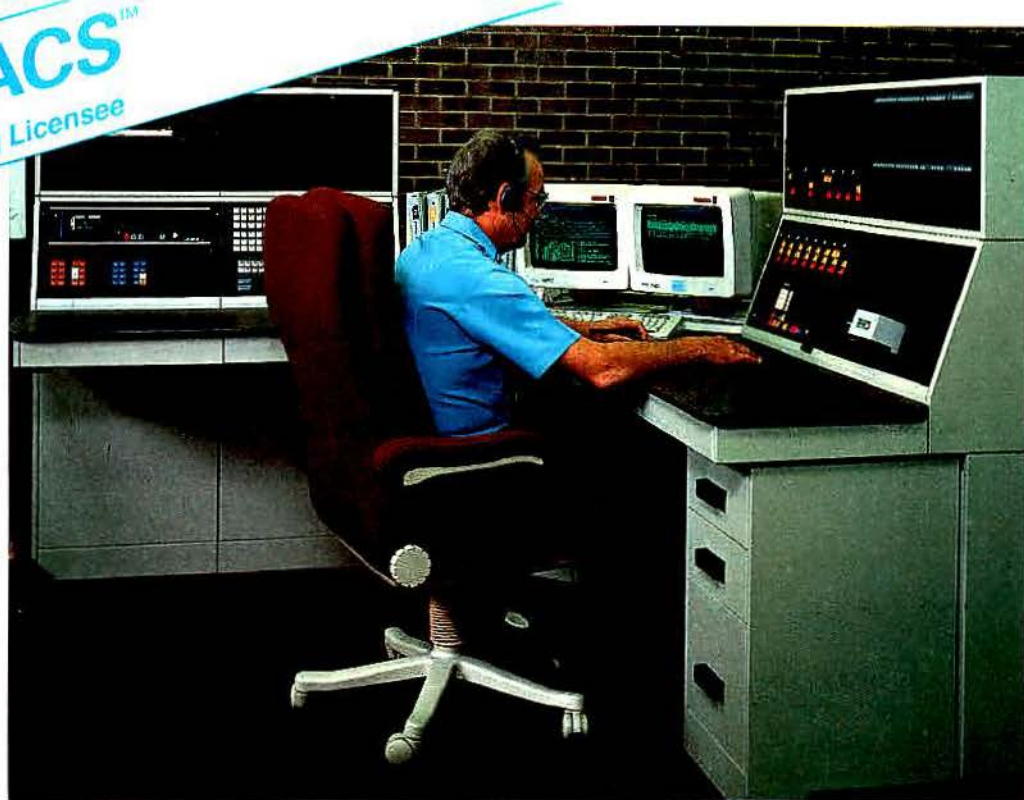
FAX 708/924-9078

POWER AMPLIFIERS FOR ALL INPUT LEVELS

- VHF Low Band to 300 watts
- VHF High Band (140-200 MHz) to 500 watts
- UHF Low Band (400-550MHz) to 350 watts
- UHF High Band (800-960MHz) to 140 watts
- True continuous rating at high ambient temperatures
- FCC type accepted

Circle (18) on Fast Fact Card

When every second counts...



TDM-150: Our state-of-the-art, 120+ channel console

Count on the reliability and performance of communications consoles from Orbacom

In an emergency, reliable communications are the lifeline for survival. That's why so many communications systems rely on Orbacom's CALIDA and TDM-150 consoles. Their superior performance and solid dependability have been proven in the most demanding applications.

If you need the control flexibility of a big console on a small budget, CALIDA is for you. CALIDA handles 16 channels, includes a multi-format paging and signalling encoder, is completely user programmable, and features a 12/24 hour clock, VU meter, alert tone, crosspatch, service intercom, desk mic with PTT and monitor switches, surge protection, and a wealth of other professional features.

If your service requires a state-of-the-art dispatch console, Orbacom's TDM-150 is the solution. TDM-150 is a custom system, so we'll configure it the way you need it — up to 120 channels or more and 120 positions. TDM-150 uses time-

division multiplex (TDM) digital audio processing and complete microprocessor control. Operation is simple and menu-driven. Reliability is ensured through surge protection, self-healing diagnostics, and battery backup. Eight levels of multi-channel radio and telephone patch may be run simultaneously, and an internal paging signalling encoder generates any sequence you'll ever need. Plus the best two-year console warranty in the business.



CALIDA: Big console flexibility for smaller systems



Mini-TDM-150 Desktop Console

Take your pick. CALIDA for professional performance in smaller systems. And TDM-150 for state-of-the-art performance on 120 channels or more. Either way you can count on Orbacom. Our communications consoles are the most reliable you can buy, and have been since 1970.

Call (609) 829-4455
 and let Orbacom solve your
 dispatching problems. Orbacom
 Systems, Inc., 1704 Taylors Lane,
 Cinnaminson, NJ 08077;
 FAX: (609) 829-6980.



Circle (19) on Fast Fact Card

Servicing pagers: Build a shielded room

Part I—A do-it-yourself shielded room helps to isolate a signal generator from nearby paging transmitter signals while troubleshooting pagers. Here are some suggestions for building your own.

By David Ludvigson

When servicing any type of pagers, certain requirements must be met to guarantee good-quality results.

In large metropolitan areas, such as Houston, many paging transmitters *always* are operating; therefore, pager alignment usually is difficult because the signal generator's output may be "swamped" by an on-frequency paging transmitter.

To date, the only effective means of isolating these signal sources has been to enclose the test equipment and the operator within a copper shield.

Manufactured shielded rooms that are big enough *are* expensive; nevertheless, after setting up the signal generator and trying to align a pager without any shielding, I soon realized that patience and saint-hood await the technician working under those conditions!

In the corner of an electronics outlet

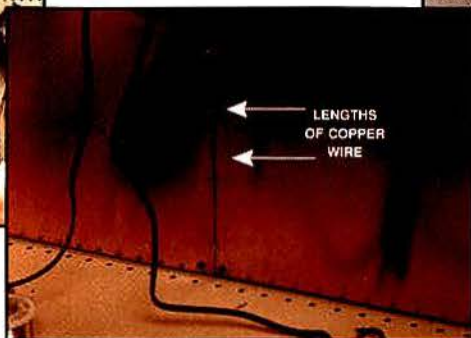
Ludvigson is a technician in Houston.



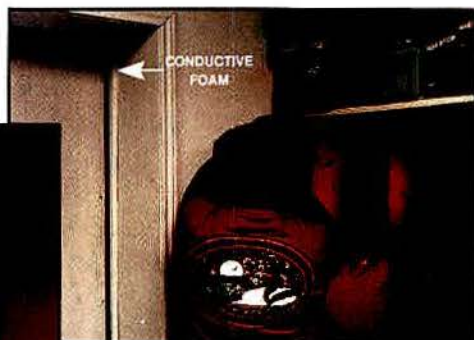
Four pieces of double-sided printed circuit board material make up the back wall of the test bench.



Raymond, my co-worker, cuts the aperture for the ac power lines.



Lengths of 12-gauge tinned solid copper wire are soldered along the length of each seam.



Raymond checks the wall-ceiling seam. Earlier construction of the shielded room has been sheetrocked and finished. The black door strip is made of conductive foam.

POWER ON... with ASTRON.

Astron Corporation is the leading manufacturer of high-quality power supplies and converters for the land mobile industry.

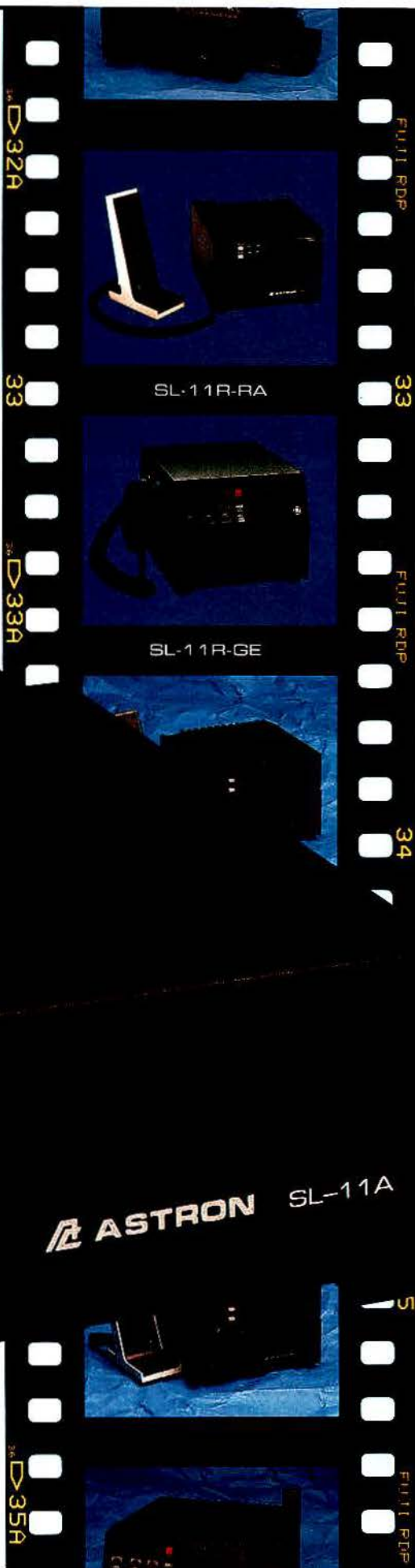
With the new SL-11 series of low profile power supplies, specifically designed for base station applications, the setup is simple, easy and looks attractive. Just mount the radio, with the mounting pads (supplied with the power supply), to the top of the SL-11A (2 $\frac{3}{4}$ " H x 7 $\frac{5}{8}$ " W x 9 $\frac{3}{4}$ " D) or the SL-11R (2 $\frac{3}{4}$ " H x 7" W x 9 $\frac{3}{4}$ " D). The power supplies are very well regulated and will provide 11 amps of current at a 50% duty cycle. The units have fold-back current limiting to protect them from overload and short circuit, and an overvoltage protection feature to protect the radio should the output voltage exceed a safe level. All SL series units are available in dark gray or black.

Power supplies and converters from Astron: our unsurpassed quality and reliability have made us the #1 choice in the communications industry.

ASTRON
CORPORATION

9 Autry, Irvine, CA 92718
Telephone: 714/458-7277
Facsimile: 714/458-0826

ASTRON SL-11A





Centrally located, the ac outlet strip is connected to an electromagnetic interference (EMI) filter behind the panel.

store I found some double-sided printed circuit board material at a reasonable price. Enough of these could tile a small room, so my employer, JJ Sounds, purchased several dozen 1.5-foot \times 2-foot sheets.

With boards of these dimensions, about 78 sheets are required to cover the walls, floor and ceiling in a room measuring 4 feet \times 8 feet \times 6 feet. Additional pieces of circuit board are needed to finish the door, and special attention is required around air

conditioning vents, lighting fixtures and ac power outlets.

The framework is a curious mixture of 2" \times 4" and 2" \times 2" materials. Sheetrock screws secure the circuit board material to the frame, with lengths of 12-gauge, tensilized, solid copper wire soldered every four inches to adjoining tiles on the top, sides and bottom.

Small holes were drilled to pass ac power lines, and electromagnetic interfer-

ence (EMI) filters were placed between the power source and the outlet strips located inside the room.

The door presented an interesting problem because it had to present a sealed plane in common with the walls and floor. A length of conductive foam was used as a pressure seal against the closed door.

Accompanying photographs show the crew of JJ Sounds building the test bench for the homemade shielded room.

Although the idea of using circuit board material may be innovative, the construction is a large undertaking. No matter what, the room is never perfectly square. Gloves and masks should be worn when cutting tiles to size for protection from copper chips and fiberglass dust.

The walls may be finished in anything from sheetrock to carpeting, but the floor requires plywood over the copper-clad fiberglass to distribute the technician's weight without cracking the circuit board material. It might be fair to equate the care and construction of the shielded room to that taken in building the pyramids of Egypt—if labor may be provided in place of currency, the shielded room is relatively inexpensive.

The do-it-yourself shielded room's over-

Part 88 compliant—today!

WHEN TRAGEDY STRIKES, LACK OF COMMUNICATION IS A REAL DISASTER



Whether it's co-ordinating Search and Rescue teams or dealing with ground relief support groups, a portable communications system is an absolute priority in times of emergency.

The Tait Portable Repeater Station has been designed to be put into action immediately, effectively. Light, robust and 'showerproof', the Portable Repeater Station can handle a network of mobile and handheld radio transmissions in the most remote of terrain.

Wherever life is in danger, the Tait Portable Repeater Station brings the promise of help.



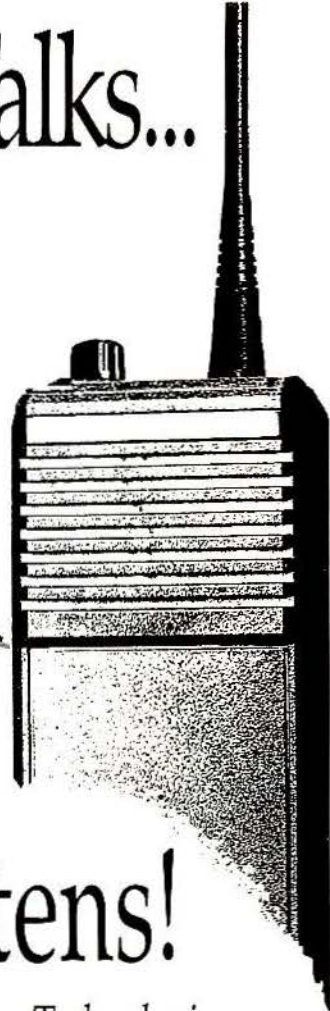
Tait Electronics U.S.A. Inc.

9434 Old Katy Road, Suite 1
Houston Texas 77055, USA Phone (1) (713) 984-8661
Outside Texas 800 222-1255 Fax (1) (713) 468-6941

Circle (21) on Fast Fact Card

Now When Your ANI Talks...

EMERGENCY!
UNIT 1082
MAN-DOWN



The Whole Fleet Listens!

Introducing Automatic Voice Alerting, Only From Cimarron Technologies

When the situation turns critical, your people need to know about it. Fast. That's why our Automatic Voice Alert system sounds the alarm with synthesized voice, over your radio channel or local PA. Quickly and accurately, so everyone gets the word.

HERE'S HOW IT WORKS

Your GE-STAR® equipped radio sends the push-button

Emergency or Man-Down ANI message in less than a half second. Our C-MARK dispatch display then decodes the digital message, sounds an audible alarm, flashes the unit ID and message display, and logs it to a printer.

AND NOW HEAR THIS

Then the C-MARK, with Automatic Voice Alert, keys the dispatcher's radio and broadcasts the unit number and critical message phrase back over the channel (contention free), as well as to its internal speaker or your local PA.

TAG-1 ANI encoder sends Emergency and Man-Down messages from your remote radio

SE HABLA ESPANOL... PARLEZ VOUS FRANCAIS
Plus, our Automatic Voice Alert can be optionally supplied with any phrases, in any language you choose. So the message gets across, wherever you are.



The C-MARK II dispatch display sends Automatic Voice Alert messages back over the air

Automatic Voice Alert works with our TAG-1 ANI encoders, or in any GE-STAR® compatible ANI system.

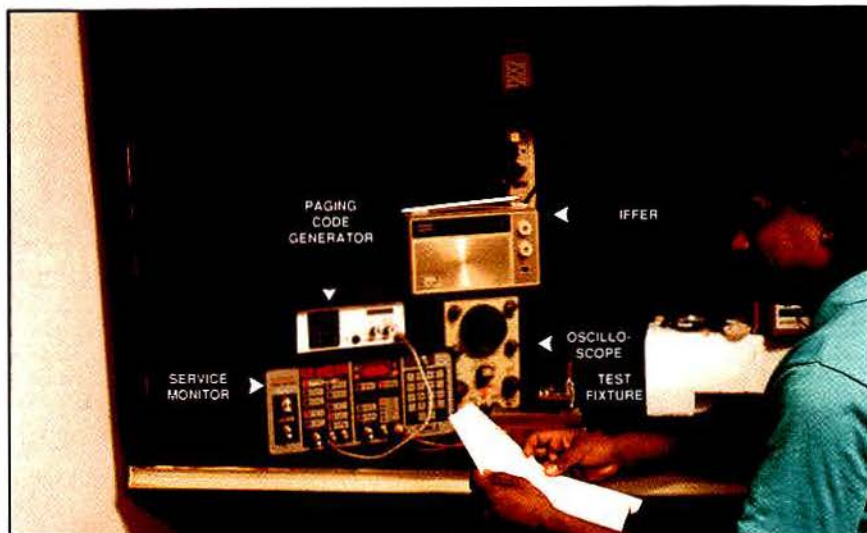
AND THERE'S MORE

We offer the most feature filled and innovative GE-STAR® compatible ANI in the industry. To find out more, call toll-free in the U.S. 1-800-487-7184 or (619)-738-3282.

**CIMARRON
TECHNOLOGIES**

GE-STAR is a registered trademark of General Electric Corporation

Circle (22) on Fast Fact Card



Once it is covered with dark speaker-box carpeting, the shielded room becomes as dark as a tomb! The Ramsey Com 3 service monitor serves as a test monitor. Above the monitor is a Cushman POCSAG and Golay paging code generator. The Motorola RTL-1005 radiation test fixture is in front of an old RCA oscilloscope. Above the scope rests the IFFER, a piece of test equipment built by the author. Pete, another co-worker, consults a frequency and format chart.

all performance has been good.

Reception on transistor radios and TV sets dies when they are placed in the room. Pagers at 931MHz are almost deaf to paging transmitters located three miles away,

reducing their interference by more than 50dB.

To hear any of the paging transmitters on the Ramsey Com 3 service monitor requires an external antenna fed through

coax; otherwise, the paging transmitters are just background noise.

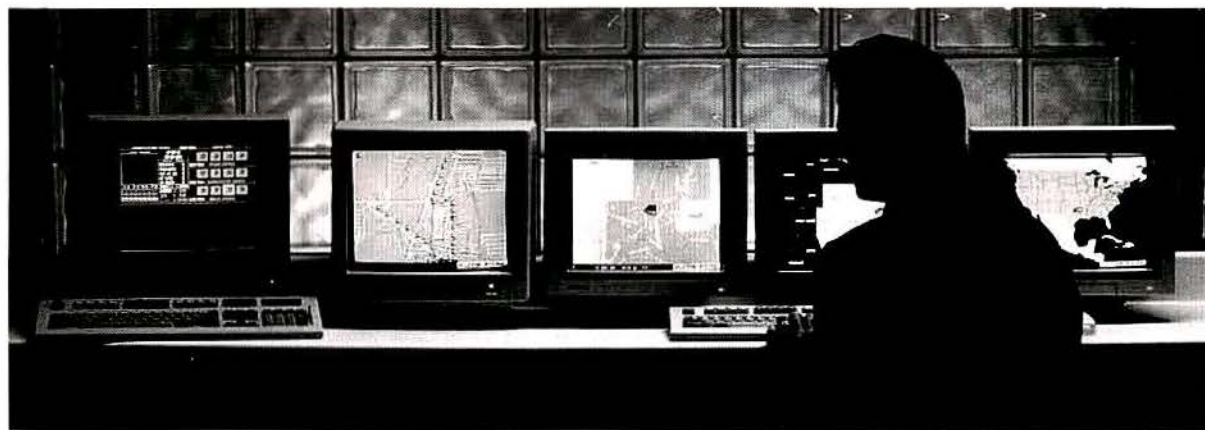
Justification for building a shielded room is a matter of individual test locations relative to nearby paging transmitters. If a repair location is within several miles of many transmitters, the quality of pager alignments will improve drastically when using a shielded room.

Acknowledgement

I would like to thank J.H. Kim, owner of JJ Sounds, South Houston, TX, and my co-workers Raymond, Tim and Pete, for their help with this project.

Postscript

"Copper coffin" is my nickname for the do-it-yourself shielded room because receivers "die" when they are brought inside of it. The editor thinks it is too morbid a name to use in the article title, but I like it. I'm experimenting with using aluminum foil to build a shielded room called the "tin foil tomb."



Auto-Trac's Fleetservice System is *your* map to success.

Auto-Trac's Fleetservice System gives you a cost effective leading-edge solution for all vehicle tracking applications. The Fleetservice System incorporates the latest in GPS technology, two-way data communications and computerized graphic mapping to improve your fleet planning, dispatching, tracking and safety. The computerized maps display each vehicle's location and status so you can act quickly and accurately to various situations. The Fleetservice System gives you precise information in an instant.



Progress from the 20th to the 21st Century with Auto-Trac!

For more information or a free evaluation of the Fleetservice System call (214) 480-8145 or fax (214) 907-2292.

AUTO-TRAC

9330 LBJ Freeway
Suite 380
Dallas, TX 75243

Circle (23) on Fast Fact Card

Catch the winning spirit.

From the forge of world-wide competition comes the new Hustler *Spirit* series of vertical antennas.

Designed to win the race to provide the highest performance and durability possible, at a price that leaves others in the dust.

If you are driven to achieve a superior signal; if you need an antenna which is virtually impervious to wind and weather; if you want the best the world has to offer, catch our new *Spirit*-and win today.

Model Shown: HS9-45070

Also Available: Models from 136 MHz. to 2 GHz, including Land Mobile, Cellular, Trunking, SMR, Paging and PCN. All models available in a variety of gain configurations.

Radiation Pattern
(Relative Field)

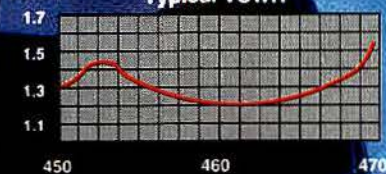


Vertical

(0.5 Below Horizontal)

VSWR

Typical VSWR



dBd

Gain (Relative to 1/2 Dipole)



Beyond your Expectations

One Newtronics Place
Mineral Wells, Texas 76067
1-800-949-9490 • (817) 325-1386

YES, I'm interested in the new *Spirit*.
Please send me your latest Professional
Products catalog.

Name

Company

Address

City State Zip

Circle (24) on Fast Fact Card

Quality management for service facilities

Part I—The type of maintenance management you practice helps to determine the kind of data you can gather to use in making decisions. The data are best gathered via an analysis of local conditions.

By Donald E. Koehler

Much has been made lately of *Deming* management.

Some people claim results with Deming management that border on the unbelievable. This management tool probably is one of the most important you can apply to your service facility, agency repair center and business.

Deming management is named after Dr. W. Edwards Deming, author of *Out Of The Crisis* and several other books on using statistical analysis as a management tool.

Deming management, also known as *total quality management, quality analysis and results-oriented management*, seeks increased productivity, reduced costs and better customer support. These results are gained through a team effort involving service employees and managers, supported by decisions based on observable data.

Statistical analysis is a competitive lifeline for current and future operations. A comprehensive *quality management (QM)* plan acquires hard statistics. Analyzing and applying the data to business decisions:

- (1) uncovers hidden costs in doing business.
- (2) reduces radio and system downtime with the use of performance-based maintenance.
- (3) provides your sales force with a powerful tool.
- (4) allows better resource allocation based on demonstrated need.

Maintenance management

Here are four kinds of maintenance

Koehler is a technical writer; technical resource researcher; and computer, communications and database specialist for Hartec Management Consultants, Anchorage, AK.

Analyzing and applying data . . .

- ☐ uncovers hidden costs in doing business.
- ☐ reduces radio and system downtime with the use of performance-based maintenance.
- ☐ provides your sales force with a powerful tool.
- ☐ allows better resource allocation based on demonstrated need.

management used by some service facilities and some of their results.

► *Reactive*—Repair starts when the radio quits. The customer loses the use of the communications system and is unhappy about it. Reactive management, often perceived as the least expensive method, actually is more costly.

► *Preventive*—Technicians routinely perform maintenance and replace parts, just in case. This approach drives costs higher

equipment life and reduce repair costs. The customer experiences less down time. The procedure generates data that may be used as a sales tool.

► *Cost-based*—Preventive maintenance is performed during system downtime, whether scheduled or unscheduled. This procedure makes more sense when downtime is expensive or difficult to arrange, or the repair site is difficult to reach.

Building a database

The type of maintenance management you currently do or do not practice determines the type and quality of data that can be collected. If your practice is to react to maintenance problems, then recording your actions as database items gives a starting point for analysis.

If your maintenance program includes actions taken before problems happen, then recording these actions, as well as outages, on a database makes analysis easier. If you do not track labor and parts costs or use automated billing, then starting an automated database is a key step.

Hard data on equipment type, model and serial number; repair labor time; and parts used are required to answer these types of QM questions:

- (1) How often does this model require maintenance?

The type of maintenance management you currently do or do not practice determines the type and quality of data that can be collected.

while achieving a somewhat better on-line performance that the customer may see as an improvement.

► *Performance-based*—Equipment performance analysis drives replacement. Detailed checks and adjustments extend



This Year's Hottest Gift Item

Loaded with features, the **COM-120A** continues IFR's tradition of supplying the most cost-effective, feature-intensive instruments in the industry. With the **COM-120A** you get

as standard:

- 2 μ V receiver
- Antenna protection
- Split screen spectrum analyzer
- Cross-band duplex
- High resolution EL Display
- Quick-change, internal, rechargeable battery

as options:

- Tracking generator
- Analog and digital signalling
- AMPS mobile station test
- CLEARCHANNEL LTR® radio test
- IEEE 488 interface

If these features are on your list of requirements, then the **COM-120A** should be under your tree.

For additional information contact...

CLEARCHANNEL LTR® is a registered trademark of CLEAR CHANNEL, INC.


Season's Greetings

IFR SYSTEMS, INC.

10200 West York Street
Wichita, Kansas 67215-8935 U.S.A.
Phone 316/522-4981
TWX 910-741-6952, FAX 316/522-1360

Circle (25) on Fast Fact Card

- (a) How many hours has it been used?
- (b) Which sub-assemblies are repaired and replaced most often?
- (c) What are its performance trends?
- (d) Are its performance characteristics based on an individual component (such as a radio) or on an entire system (including antenna, cavity, radio and interconnections)?
- (2) Does a particular brand of X (e.g., battery or microphone) perform better or

last longer than any other brand of the same item?

- (3) Can similar items be stocked for more than one system?
- (4) Can maintenance actions be based on performance rather than a time basis?

Data analysis

Looking at data generated by maintenance employees can reveal hidden costs. For example, one battery brand may

Maintenance management

Service facilities generally use one or more of the following kinds of maintenance management:

- ☐ Reactive.
- ☐ Preventive.
- ☐ Performance-based.
- ☐ Cost-based.

CHECKMATE IV
THE NEXT GENERATION

Providing Tone and Voice Pagers for over twenty years.

FEATURES:

- Choice of reader or Programmable Decoder
- Reed - High Sensitivity
- Programmable - Increased Option Features
- Rugged Black or Red Case
- Small Size - 3 1/8" x 2 7/16" x 1 5/16"
- Single "AA" Battery
- Variable Volume Control
- Group Call Standard on Second Tone
- Channel Monitoring Capability
- 3 Year Limited Warranty Standard
- 4 & 5 Year Limited Warranty Available

SHINWA Communications of America Inc.
P.O. Box 26407
Oklahoma City, OK 73126
TEL 1-800-627-4722
FAX 1-800-759-1722

SHINWA Tsushinki Co., Ltd.
12-2 Hamadayama 4-Chome
Suginami-Ku Tokyo, Japan
TEL (03) 3313-1211
FAX (03) 3313-1218
TELEX: J27432 Sinwacom

Circle (26) on Fast Fact Card

outperform another, less expensive brand. Without statistical analysis, this fact may go unnoticed.

If the supplier can provide the *mean time between failure* (MTBF) for the equipment, this information helps you to design a performance-based maintenance program. If your customer does not specify a maintenance plan or agreement with the equipment purchase, MTBF data can be used to help to sell such a program.

Even better are data gathered by your company via an analysis of actual, local conditions. When the customer is shown a chart or graph based on your data that a more expensive radio has a much higher MTBF, a better sale may result.

A firm grasp of equipment performance gives you the edge when you respond to a

Looking at data generated by maintenance employees can reveal hidden costs.

request for bid (RFB) or a request for proposal (RFP). All too often, service and maintenance contractors are hurt by costs or equipment failures not accounted for in the contract bid planning. Statistical analysis may make the difference between a profitable venture and finding out what the contract's liquidated damages clause is all about.

QM books

The preceding points are intended to start you thinking about how you conduct

In answer to all your questions

Will you support flex high-speed paging? Can you handle major throughput demands? Can you accommodate our growth easily and cost efficiently? Does the system act as a concentrator? Do you support ISO 9000 quality standards? Will you have fax store and forward? Are you

right build... come... market?
Should... architecture
provide... system fully
expanda... offer... technically
advanced... ing? Is... terminal
act as a co... remote? system modular g... 100%
salvage? V... system
sophistica... platform

really the people who originated the 3000 series? Is your system the top competitive alternative? Is it true that live operator services, TNPP, dispatch and "meet me" are all standard? Do you support full switching capabilities? Are you really that much less expensive?

Yes, yes, yes, yes, yes, coming soon, yes...



TELELINK DS5000 *Paging Systems*

U.S. and Canada Sales: 1-800-567-8884 Service: 1-800-567-5055

Circle (27) on Fast Fact Card

your service business. Future installments in this series will include examples of the types of data to gather and methods for charting performance.

More detail on QM programs can be found in various books available in public libraries, generally in the section bearing Dewey decimal numbers of 658 or 658.5.

The first book to look for is Deming's *Out Of The Crisis* (ISDN# 0-91137901-).

Another book, Dr. Juran's *Juran On*

Leadership For Quality (ISDN# 0-02916682-9) is helpful. Alternatively, the same author's *Juran's Quality Control Handbook* and *Juran On Leadership For Quality: An Executive Handbook* are helpful.

I also recommend the following four books:

Handbook For Quality Circles (ISDN# 0-8160-1161-3) by Crocker, Charney and Chlu.

Quality Without Tears by Philip B. Crosby.

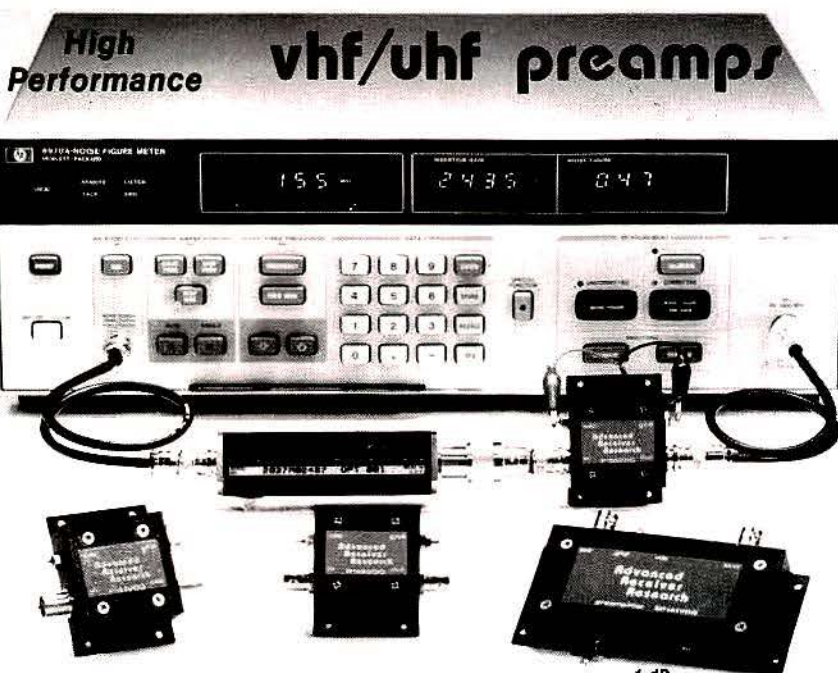
Total Quality Management by Joseph R. Jablonski.

Malice In Blunderland by Thomas L. Martin, 1972 edition.

Martin's book is included in the list because changing how things are done in your operation may prove more difficult than you first may think. QM is not a new management style, nor is it *management by objective* in a new cover.

QM is nothing less than the rethinking of business and management philosophy. Martin points out the pitfalls awaiting the manager who institutes change. It will not be easy, but change is necessary to stay competitive. Everyone involved in the business must be part of the team and take responsibility for the venture's success.

The next installment in this series shows the need for automated data-gathering and some of the whys and hows. It includes an example or two that show why automated data-gathering is one of the better ways to make a QM plan work.



Receive only	Freq. Ranges (MHz)	1 dB		Device Type	Price
		N.F. (dB)	Gain Comp. (dB) (dBm)		
P30VD, P35VD, P40VD, P45VD	30-35, 35-40, 40-45, 45-50	<1.3	15	0	DGFET \$ 44.95
P30VDG, P35VDG, P40VDG, P45VDG	30-35, 35-40, 40-45, 45-50	<0.5	26	+12	GaAsFET \$109.95
P150VD, P160VD, P170VD	150-160, 160-170, 170-180	<1.5	15	0	DGFET \$ 44.95
P150VDA, P160VDA, P170VDA	150-160, 160-170, 170-180	<1.1	15	0	DGFET \$ 56.95
P150VDG, P160VDG, P170VDG	150-160, 160-170, 170-180	<0.5	24	+12	GaAsFET \$109.95
P450VD, P460VD	450-460, 460-470	<1.8	15	-20	Bipolar \$ 49.95
P450VDA, P460VDA	450-460, 460-470	<1.2	16	-20	Bipolar \$ 74.95
P450VDG, P460VDG	450-460, 460-470	<0.5	16	+12	GaAsFET \$109.95
P800VDG, P830VDG, P860VDG	800-830, 830-860, 860-890	<0.6	19	+12	GaAsFET \$119.95
Inline (rf switched)					
SP30VD, SP35VD, SP40VD, SP45VD	30-35, 35-40, 40-45, 45-50	<1.4	15	0	DGFET \$ 74.95
SP30VDG, SP35VDG, SP40VDG, SP45VDG	30-35, 35-40, 40-45, 45-50	<0.55	26	+12	GaAsFET \$139.95
SP150VD, SP160VD, SP170VD	150-160, 160-170, 170-180	<1.6	15	0	DGFET \$ 74.95
SP150VDA, SP160VDA, SP170VDA	150-160, 160-170, 170-180	<1.2	15	0	DGFET \$ 86.95
SP150VDG, SP160VDG, SP170VDG	150-160, 160-170, 170-180	<0.55	24	+12	GaAsFET \$139.95
SP450VD, SP460VD	450-460, 460-470	<1.9	15	-20	Bipolar \$ 79.95
SP450VDA, SP460VDA	450-460, 460-470	<1.3	16	-20	Bipolar \$104.95
SP450VDG, SP460VDG	450-460, 460-470	<0.55	16	+12	GaAsFET \$139.95

Every preamplifier is precision aligned on ARR's Hewlett Packard HP8970A/HP346A state-of-the-art noise figure meter. RX only preamplifiers are for receive applications only. Inline preamplifiers are rf switched (for use with transceivers) and handle 25 watts transmitter power. Mount inline preamplifiers between transceiver and power amplifier for high power applications. System S/N improvement 6-14 dB typical. Other amateur, commercial and special preamplifiers available in the 1-1000 MHz range. Please include \$2 shipping in U.S. and Canada. C.O.D. orders add \$2. Air mail to foreign countries add 10%. Order your ARR RX only or inline preamplifier today and start hearing like never before!

**Advanced
Receiver
Research**

Box 1242 • Burlington, CT 06013 • 203 582-9409



Circle (28) on Fast Fact Card

Express yourself

Something bothering you? Want to sound off about it?

Need help that other readers might provide?

Send a letter to:

Letters to the editor
Mobile Radio Technology
P.O. Box 12901
Overland Park, KS 66282-2901



In wireless communications,
almost making a deadline
just isn't good enough.



© 1993 Hewlett-Packard Co. TMSPK01/MR

The pace is fast and furious. Yet you manage to face each new RF communications challenge with true brilliance and dedication. All you need to finish the job is one more day.

Problem is, you haven't got it.

At Hewlett-Packard, we understand the kind of pressure you're under. So we created RF communications test and measurement solutions designed to turn those

impossible deadlines into something you can shoot for — and meet.

The result is equipment that's made to handle your specific testing requirement today. With the speed and accuracy you'd expect from HP. Plus, the support and product development to help you face future challenges without hesitation.

Because when the only thing between you and your goals is time — HP is ready to help

bridge the gap.

For your free brochure on HP RF communications test and measurement solutions, call **1-800-452-4844** and ask for **Ext. 7404***, or send in the attached reply card.

*In Canada call 1-800-487-2867, Dept. 474

There is a better way.



**HEWLETT
PACKARD**

Technology update: 5kHz linear modulation

With the ever-increasing demand for radio spectrum, linear modulation offers a real solution for users and regulators and surprising performance. The 220MHz users will be first to enjoy the advantages; others will follow.

By M.R.J. Bayly, C.Eng.

In many developed countries around the world, radio spectrum for mobile communications is scarce.

Regulators look for spectrum-efficient technologies to satisfy mobile radio users whose communications products and services contribute to economic growth.

Technological developments enable higher and higher radio frequencies to be used for mobile communications, but there is an upper frequency limit for the economical use of radio frequencies for private, single-user systems that cover wide areas with a low density of mobile units.

The reason is that the number of users per channel per given area, compared to public systems such as cellular telephone and specialized mobile radio (SMR), is somewhat lower, and the usable range from a site is optimum. About 500MHz is considered to be this upper limit.

Channel spacing is a critical issue as more individual users want access to frequencies below 500MHz.

The solution

Research has been carried out at the University of Bristol in the UK for a number of years in transparent tone-in-band (TTIB) single-sideband (SSB) systems by Professor Joe McGeehan. The results have superior properties.

My employer, a \$1 billion UK company with core businesses in the security, overnight parcel delivery and communications industries, took up the challenge to de-

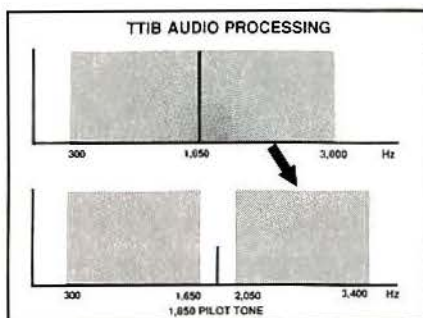


Figure 1. With transparent tone-in-band linear modulation, a tone is inserted in the audio baseband in the transmitter by splitting the audio band and upconverting the upper part of the baseband to make room for the tone. The pilot tone is used as a reference for decoding in the receiver.

velop a 5kHz radio system based on the TTIB system. The company operates Relayfone III, a network of regional, multisite, trunked radio systems, for its own use and for use by third parties. The network needed additional channels to satisfy customer demand.

Linear modulation

Linear amplifiers have been used for many years, yet linear modulation (LM) is new.*

The merging of four new technologies produces a radio capable of providing an extremely linear circuit end-to-end under virtually all propagation conditions. The technologies are:

► **Transparent tone-in-band**—A tone is inserted in the audio baseband in the transmitter by splitting the audio band and upconverting the upper part of the

baseband to make room for the tone. The pilot tone is used as a reference for decoding in the receiver. (See Figure 1 to the left.)

► **Cartesian loop transmitter (CLT)**—A nonlinear class AB RF amplifier with a basic third-order harmonic intermod performance of around 20dB is linearized through an active I & Q feedback error amplifier to improve the typical third-order harmonic intermod performance to 70dB+.

This level provides adjacent channel performance well in excess of the FCC transmitter mask for the 220MHz band for 5kHz channels.

► **Feed-forward signal regeneration (FFSR)**—The TTIB tone is extracted in the receiver, and the audio baseband is recombined exactly in phase and amplitude.

The tone then is used as a reference to cancel out the effects of multipath and Rayleigh fading and the Doppler effect to provide a consistently clear signal under virtually all propagation conditions.

► **Digital signal processing (DSP)**—Real-time digital signal processing helps

The merging of four new technologies produces a radio capable of providing an extremely linear circuit end-to-end . . .

to make the use of transparent tone-in-band, Cartesian loop transmitter and feed-forward signal regeneration possible.

The result is a high-quality audio signal with excellent voice recognition. The signal has a soft degradation at the edge of its range that makes it much more acceptable

Bayly is U.S. marketing manager for Securicor PMR Systems, Bath, Avon, United Kingdom. He has an M.I.E.E. degree, and he has been involved in mobile radio engineering, sales and marketing for more than 33 years. Cycomm, Fairfax, VA, is Securicor's manufacturer representative in North America.

*Editor's note: Although other forms of linear modulation have been in use for many decades, it is the form implemented with the merging of four technologies that the author refers to as "new." Similarly, the abbreviation "LM" in this article refers to this new form to differentiate it from other types of modulation, such as amplitude modulation (AM), frequency modulation (FM) and single-sideband (SSB).

4 New Winners from Midian

\$5995

A Model ANI-U



Smallest Multi-Format, Multi Feature ANI with optional CTCSS encode

- ANIs: DTMF, CCIR, ZVEI, DZVEI, DDZVEI, NATEL, EEA, EIA, & MODAT*
- Optional 51 code CTCSS encoder
- Delayed CTCSS for inaudible ANI
- User-programmable tone timings
- Leading and/or Trailing ANI with mic mute
- Programmable ANI repeat delay timer
- Emergency ANI with repeat timer
- Emergency ANI "man down" delay timer
- Programmable ANI speed & front porch delay
- Timeout Timer with stuck mic alert tone
- Available for Midian Zap™ & GE-Star® digital ANI formats (DFA-1/DFA-2)
- Dimensions: 1.1" x .88" x .22"

A Model RT-8X/TRA



RTX-compatible Telephone to Radio Adapter

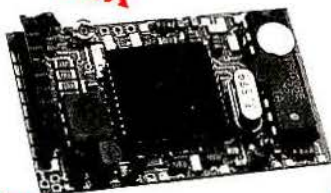
- Converts standard telephone with RJ11 connector to radiotelephone formats, rural phone, or extended phones when interfaced with simplex or duplex radio
- Full/Half-duplex or VOX capability
- Outputs 90 Volts to ring standard telephone bell
- Built-in dial and busy tones
- Programmable via telephone Touch Tone® keypad
- 1-12 digit connect and disconnect ANI
- 10 number memory dialer with last number redial
- Also available for DTMF interconnect applications

\$26995

Ready to Deal?

\$9995

A Model RT-8X



Programmable DTMF Encoder/Decoder Compatible with RTX

- Three programmable decode numbers for selective calling with multiple ring codes
- 1-12 digit connect and disconnect ANI
- Ten number memory dial, last number redial
- Call routing digit for CES or RTX mobile call
- Trunking delay for connect ANI
- Time Out Timer & Busy Channel Lockout
- Carrier refresh for base or repeater COR/COS
- CTCSS encoder with programmable modulation
- Deadbeat Disable for lost or stolen radios
- Programmable channel scanning
- Timed automatic disconnect
- Forced decode reset
- Dimensions: 1.84" x 1.2" x .25"

A Model ID-1



Keyboard Programmable Morse Identifier

- All messages & features programmable via 12-button Touch Tone®-style keypad with alphanumeric characters
- Sends 16-character station ID or 130-character message at programmable repeat intervals and speed
- Programmable front porch keypad delay
- Programmable morse tone freq. (1 to 3000 Hz)
- Programmable wait time after COR loss
- Can send morse tone manually
- Dimensions: 1.4" x 1.1" x .25"

\$7995

To Order Call Toll Free: 1-800-MIDIAN'S

Corporate Headquarters: (602) 884-7981 FAX: (602) 884-0422

MIDIAN

World Leader in Innovative Communications Technology

MIDIAN ELECTRONICS, INC. / 2302 East 22nd Street / Tucson, Arizona 85713

to listen to than FM in the same condition. The signal level stays consistent and, instead of chopping into noise at range edge, the noise comes up to meet the sig-

Linear modulation

Linear modulation merges four technologies:

- Transparent tone-in-band.
- Cartesian loop transmitter.
- Feed-forward signal regeneration.
- Digital signal processing.

nal, making it much easier to read low-level signals.

Relearning radio rules

RF engineers have learned theories and rules of thumb by which radio systems are designed, but the properties of LM do not obey many of these rules.

There will be a process of learning the new characteristics by which systems will be designed.

When comparing the performance of

5kHz LM to 12.5kHz FM, there is a 2dB improvement on the 14dB SINAD measurement at a 10dB protection ratio.

On the other hand, if the TTIB tone is moved 2.5kHz away from the FM center frequency, then the protection ratio becomes 0dB, and if the TTIB tone is moved 5kHz away, the ratio is -12dB. That means for a 14dB SINAD in the wanted FM signal, the LM signal 5kHz away can be +24dB up on a co-channel FM signal.

These protection ratios make it possible to farm existing PMR frequencies to provide additional 5kHz LM channels *without* causing as much interference as another FM channel. In fact, the interference is a lot less. Four LM channels could be placed within an existing 25kHz FM channel and leave the FM channel still operational with careful system planning.

LM channels actually can be overlapped for infill areas.

The possibilities are considerable for increasing the number of effective communication channels in a given area, and virgin spectrum is not necessary.

Improvements

- *Range*—Range is a function of modu-

lation, power and height; nevertheless, when we compare ratio of power to range of FM to LM, there is about a 6dB difference in favor of LM; therefore, a 25W PEP LM signal gives about the same coverage as a 100W FM signal.

- *Lower energy consumption*—An LM transmitter is much more efficient than an FM transmitter.

For 25W PEP, the LM transmitter only draws around 3A, and then only on peak modulation. This current draw compares with a 6A-8A continuous current draw for 25W FM.

An LM transmitter is much more efficient than an FM transmitter.

This difference will have a significant effect for hand-held transceivers, making possible either longer duty cycles or smaller batteries.

Keep In Touch with ACCESS™

Color Touchscreen Consoles from Avtec



ACCESS™ - Advanced Concept Communications Exchange & Signaling System for Utilities, Airlines, Gas & Oil Companies and Public Safety - A fully integrated, non-blocking, radio/telephone console system using color touchscreen technology. Touch control, pioneered by Avtec for high capacity voice communications systems, is fast becoming the new standard for dispatch consoles.

Avtec is a licensee of the ERICSSON GE MOBILE COMMUNICATIONS EDACS™ trunking system

Call or write today -
AVTEC, INC.

4335 Augusta Hwy. • Gilbert, SC 29054 USA
(803) 892-2181 • FAX (803) 892-3715

Avtec

ATTENTION

PUBLIC SAFETY ANNOUNCEMENT

Tampering with Motorola's Communication Technology is Nothing Short of a Crime.

Motorola has been at the forefront of communications technology for more than 60 years. Today, we offer a greater array of communications products than ever before. We are proud of our products and the vital services they bring to our customers which are of unparalleled public importance.

Theft of communications services and so-called High-Tech piracy threaten the entire communication industry's reputation for reliability. This conduct

not only damages the reputation of Motorola, Inc. and the communications industry, but undermines the very integrity of America's public and private communications services.

Motorola intends to combat this conduct by aggressively maintaining and enforcing its proprietary rights to its hardware and software technology. Anyone who has knowledge of illegal activities or has questions concerning such activities is urged to contact Motorola Inc. immediately at 1-800-325-4036. Contacts will be kept confidential and may be made anonymously.



Ⓜ and Motorola are trademarks of Motorola, Inc., © 1993 Motorola, Inc.



► **Lower site noise levels**—With the lower peak powers for a given range and the even lower average powers than FM, LM can be used to reduce site noise levels.

Moreover, intermodulation products are reduced by around 12dB. This reduction means easier, and hence lower-cost, site engineering.

Lower site noise improves range, too, at no additional cost.

► **Contiguous channels**—The only way

to engineer contiguous channels at present is to use lossy passive combining.

High-power linear amplifiers soon will be available with the input signals fed at low level. This technology will eliminate the lossy combiners and reduce power levels with the resultant energy savings and site noise reduction.

Data performance

The data performance of 5kHz LM ra-

dios for data is unique.

The system has been optimized for a true 9.6kb/s data rate. Testing to a fast-moving vehicle with *no* error correction shows bit-error rates (BERs) less than 1×10^{-4} (one in ten thousand).

This BER is two orders higher (100 times better) than either FM systems or even many of the proposed digital modulation systems are able to provide. Error correction with LM, then, is much less, and *true* bit rates are about four times better.

This data performance opens up new application possibilities such as slow-scan video to and from the vehicle. Patient conditions can be flashed ahead to the hospital. Real-time video can be taken to and from the patrol car. High-speed fax mes-

AUDIO ACCESSORIES

- Headsets (PTT & VOX)
- Ear & Throat Mics
- Surveillance Harnesses



**DYNATECH
TACTICAL
COMMUNICATIONS**

16 Hampshire Drive, Hudson, NH 03051
Toll Free: 1-800-233-8639 Fax: 1-603-880-6965

Circle (33) on Fast Fact Card

Improvements

Linear modulation improves:

- **Range**—LM has about a 6dB advantage over FM for a given amount of power. For example, a 25W PEP LM signal gives about the same coverage as a 100W FM signal.
- **Energy consumption**—LM transmitters consume less energy than FM transmitters for a given peak power output.
- **Site noise**—The use of lower peak and average RF power output levels for a given range compared to FM can reduce site noise levels.
- **Contiguous channels**—High-power linear amplifiers will make it possible to engineer contiguous channels without using lossy passive combining.

GET SERIOUS ABOUT YOUR DC CONVERTER

NEWMAR is serious about DC Converter reliability because we know your mobile radio system depends on it. That's why we use semi-conductors that withstand up to 100% more power than required by normal operation, and why a corrosion resistant coating is applied to all printed circuit boards. Then we encase the circuitry in a rugged heat sink chassis where it stays cool under high loads and survives the high vibration of rigorous off-road operation.

When you need a DC Converter to power radios on heavy equipment, get serious about reliability, get a NEWMAR.

Call 1-800-854-3906 for our complete product catalog.



P.O. BOX 1306, NEWPORT BEACH, CA 92663 (714) 751-0488 FAX # 714-957-1621

Circle (34) on Fast Fact Card

sages can be sent. And who knows what else will become possible now that the transmission medium is here?

Easy migration

Because all signal processing is achieved digitally, it is possible to build multimode equipment with both FM and LM modes, making the transition to LM easy and economical.

The 5kHz LM is not simply very narrowband radio (VNBR). It has low energy consumption, low bit-error rates, lower RF power for a given range, fast data transmission and high-quality voice communications.

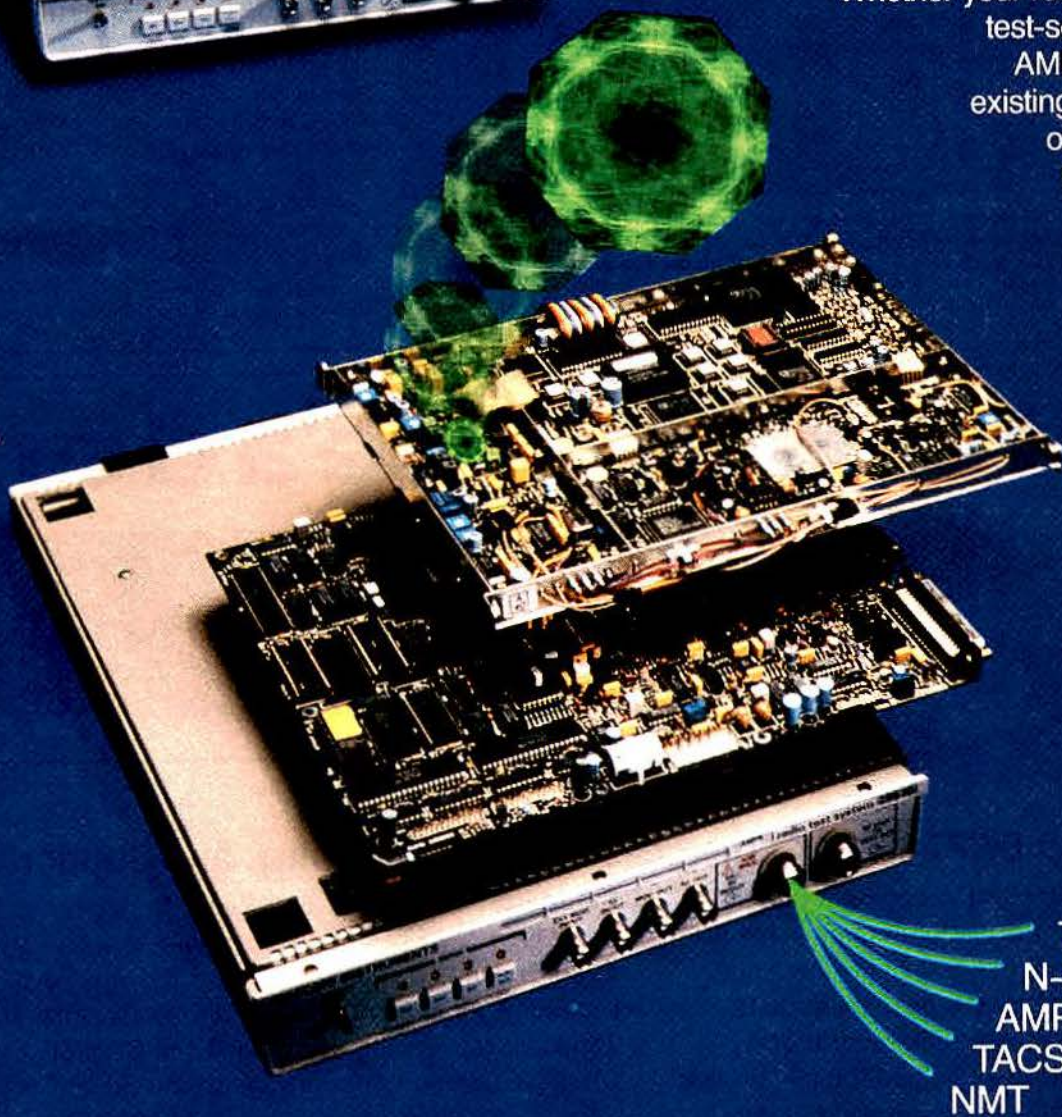
The 220MHz band already has been opened for 5kHz operation where LM will be offering user facilities previously unavailable. Developments continue in other bands to enable farming of existing spectrum with LM.



MARCONI MAGIC!



Take the covers off our cellular test-set and you'll see what's behind the Marconi Magic. Whether your requirements demand a test-set with the new Digital AMPS, Narrow AMPS, or existing cellular standards... our DSP's, ASIC's, and GAL's will create your system's language.



TDMA
N-AMPS
AMPS
TACS
NMT

Marconi
Instruments

3 Pearl Court, Allendale, NJ 07401 • 201-934-9050 • 1-800-233-2955

In Canada contact Canadian Marconi at 514-341-7630 x4695



Circle (35) on Fast Fact Card

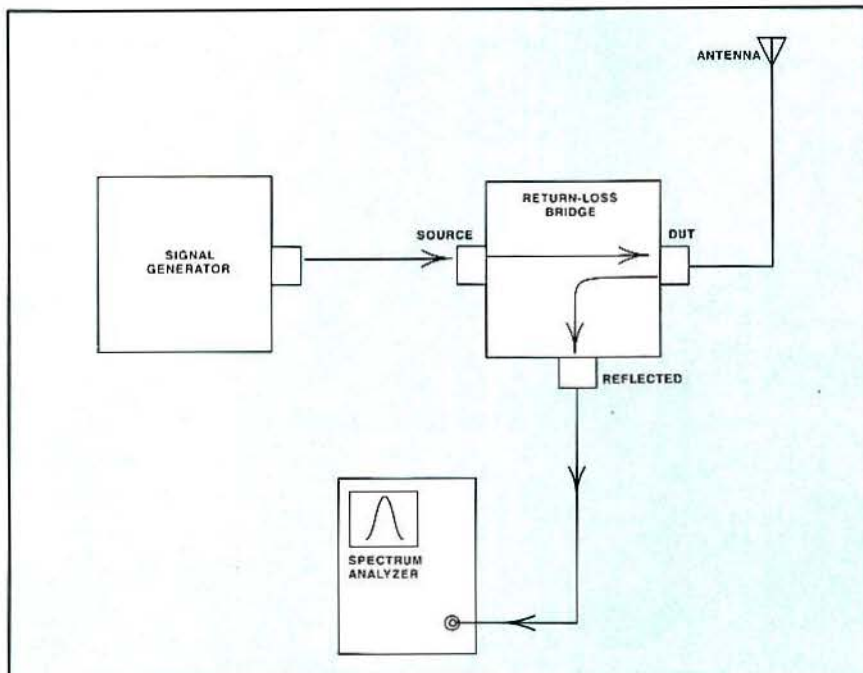


Figure 3. After the 0dB reference level has been set, the DUT (in this case the antenna) is connected to the DUT port. The signal level is measured on the spectrum analyzer and compared with the 0dB reference level. If the signal level is now at -20dB on the spectrum analyzer, then the return loss is 20dB. According to the graph in Figure 6, a return loss of 20dB is equivalent to a voltage standing wave ratio (VSWR) of approximately 1.2:1.

(continued from page 8)

strument used to make the return-loss measurement.

Calibration

Referring to Figure 2 on page 8, the calibration is done as follows:

With the DUT port left open, the signal level at the source port is adjusted to the desired level—the DUT input plus about 6dB. Normally, the exact signal level at the bridge input is not critical if a usable output is available at the reflected port.

Next, adjust the spectrum analyzer display to 0dB at the top of the screen. This will serve as the reference level.

Refer now to Figure 3 to the left. With the load (in this case the antenna) connected to the DUT port, the signal level at the spectrum analyzer will drop by an amount equal to the return loss at the DUT port. The better the match, the higher the return loss as measured by the spectrum analyzer.

In this case, the signal source is a fixed frequency, and so the return loss represents the degree of antenna match (or mismatch) at that specific frequency. If it is desirable to view the antenna's response in terms of

Follow the Leader



The Model 640 DAPT XTRA -- the Leader in Value, Quality, and Support.

The Model 640 DAPT XTRA paging terminal entered the field in 1991 with an impressive list of standard features and an amazingly low price. It quickly took the lead as the best value in its class. The DAPT XTRA's track record for reliability and support has helped it maintain that lead. Zetron's commitment to ongoing feature development and upgradability ensures that the DAPT XTRA will stay out in front for the long run.

Standard Features:

- 1,500 Pager Capacity
- 2 Telco/RS-232 Ports, expandable to 4
- 280 Seconds of Voice Storage
- System Voice Prompts
- Alphanumeric Paging
- 16 Transmitter Zones w/Sequencing
- Remote Tone Control
- Repeat Paging
- Group Paging
- Individual Call Counts
- System Alarm Output
- 24-Hour Remote Factory Support

Options: Dual TNPP Network Interface • Dual Telco/RS-232 Card • Dial Click Decoder • MF Decoder • Floppy Disk Backup

DAPT XTRA Puts You In The Winner's Circle !



12335 134th Ct. N.E.
Redmond WA 98052
Phone: (206) 820-6363
Fax: (206) 820-7031

PERFORMANCE YOU CAN TRUST...



BATTERY AFTER BATTERY AFTER BATTERY



RY AFTER BATTERY AFTER BATTERY AFT



ER BATTERY AFTER BATTERY AFTER BA

JBRO...YOUR SMART CHOICE FOR QUALITY RECHARGEABLE BATTERIES.

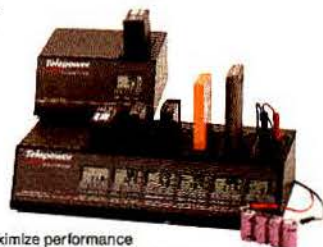
Dependable communication is critical. Dependable batteries guarantee it. That's why more and more mobile communications operators everywhere are relying on the consistent quality and outstanding performance of JBRO rechargeable batteries.

Uncompromising workmanship and an extensive line ensure you'll get maximum power and a perfect fit

for your specific application. Call today for our FREE catalog of highest quality battery products and services. Battery after battery, JBRO gives you performance you can trust!

JBRO

BATTERIES INC.



Maximize performance and life of your rechargeables with JBRO's line of Telepower® Conditioner/Analyzers.

JBRO Batteries, Inc. 1938-A University Lane Lisle, IL 60532-2150 Phone: 708/964-9358 Fax: 708/964-9081 Order Entry: 800/323-3779 Fax Entry: 800/237-6435
JBRO Batteries S.W., Inc. 25700 1-45 North #111 Spring, TX 77386 Phone: 713/367-9393 Fax: 713/292-7139 Order Entry: 800/245-1138

Circle (37) on Fast Fact Card

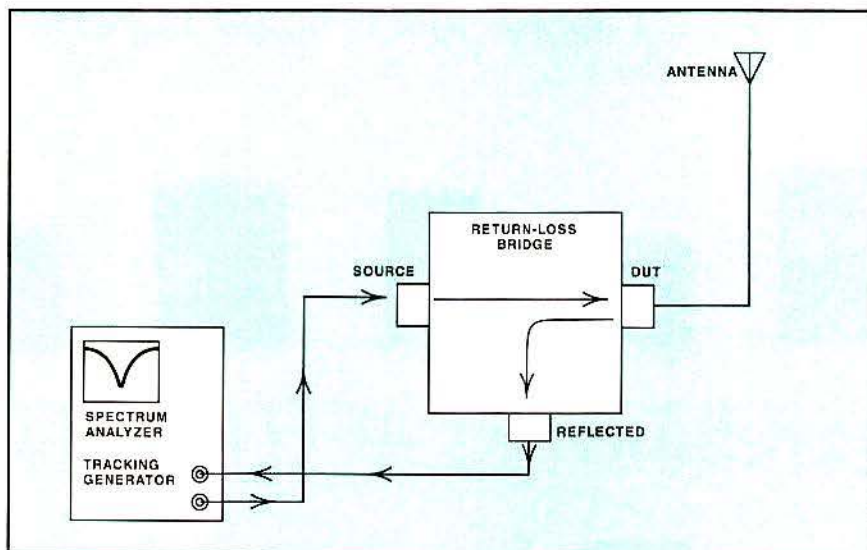


Figure 4. With a tracking generator-spectrum analyzer combination, the device under test can be tested with the sweep-frequency technique, resulting in a frequency vs. return loss display on the spectrum analyzer. The device under test (an antenna in this case) can be tuned for optimum match by watching the display and tuning for maximum dip at the center frequency.

return loss vs. frequency, a tracking generator could be used to plot a response curve on the spectrum analyzer display. Then the exact resonant frequency of the

antenna could be determined along with the voltage standing wave ratio (VSWR) bandwidth. (See Figures 4 and 5 above.)

The graph in Figure 6 on page 44 pro-

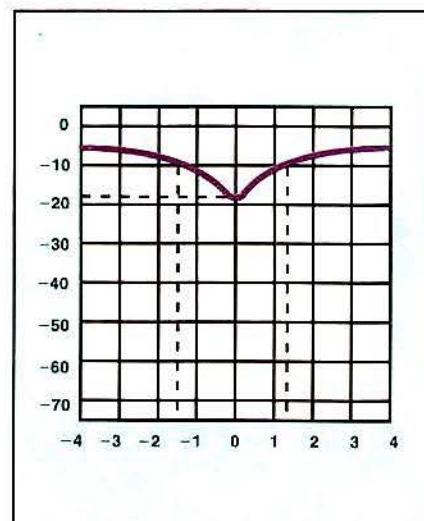
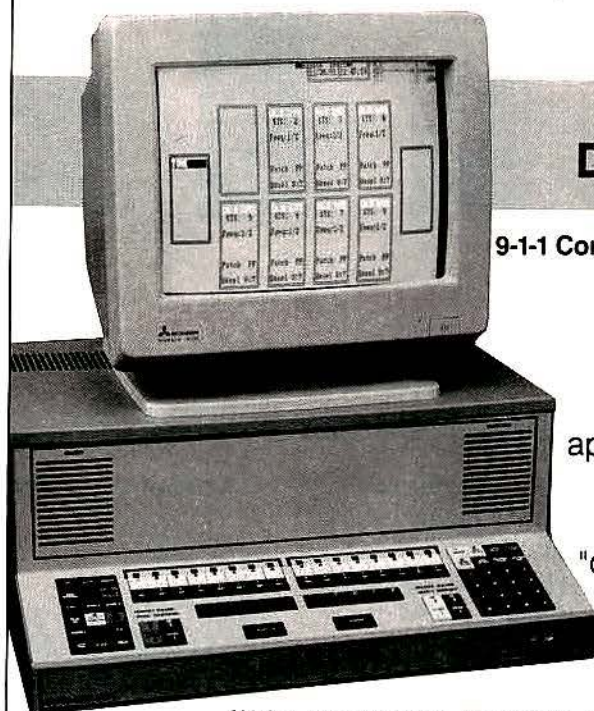


Figure 5. The bandwidth of the antenna is often taken to mean the frequency (high and low) at which the VSWR is 2:1. A VSWR of 2:1 equates to a return loss of about 9.5dB. The vertical dashed lines in this figure indicate the points on the response curve where the return loss is about 9.5dB. The frequencies are roughly 1.5MHz above and 1.5MHz below the center frequency, for a total bandwidth of 3MHz. The return loss at the center frequency is about 17.5dB for a VSWR of roughly 1.3:1.

If you've been looking for a low-cost desktop console with large-system features...

Look at the ULTRA-COM 96DT Desktop Radio Control Console

9-1-1 Compatible - with the exclusive Programming Help Menus that let you adapt your system to your requirements

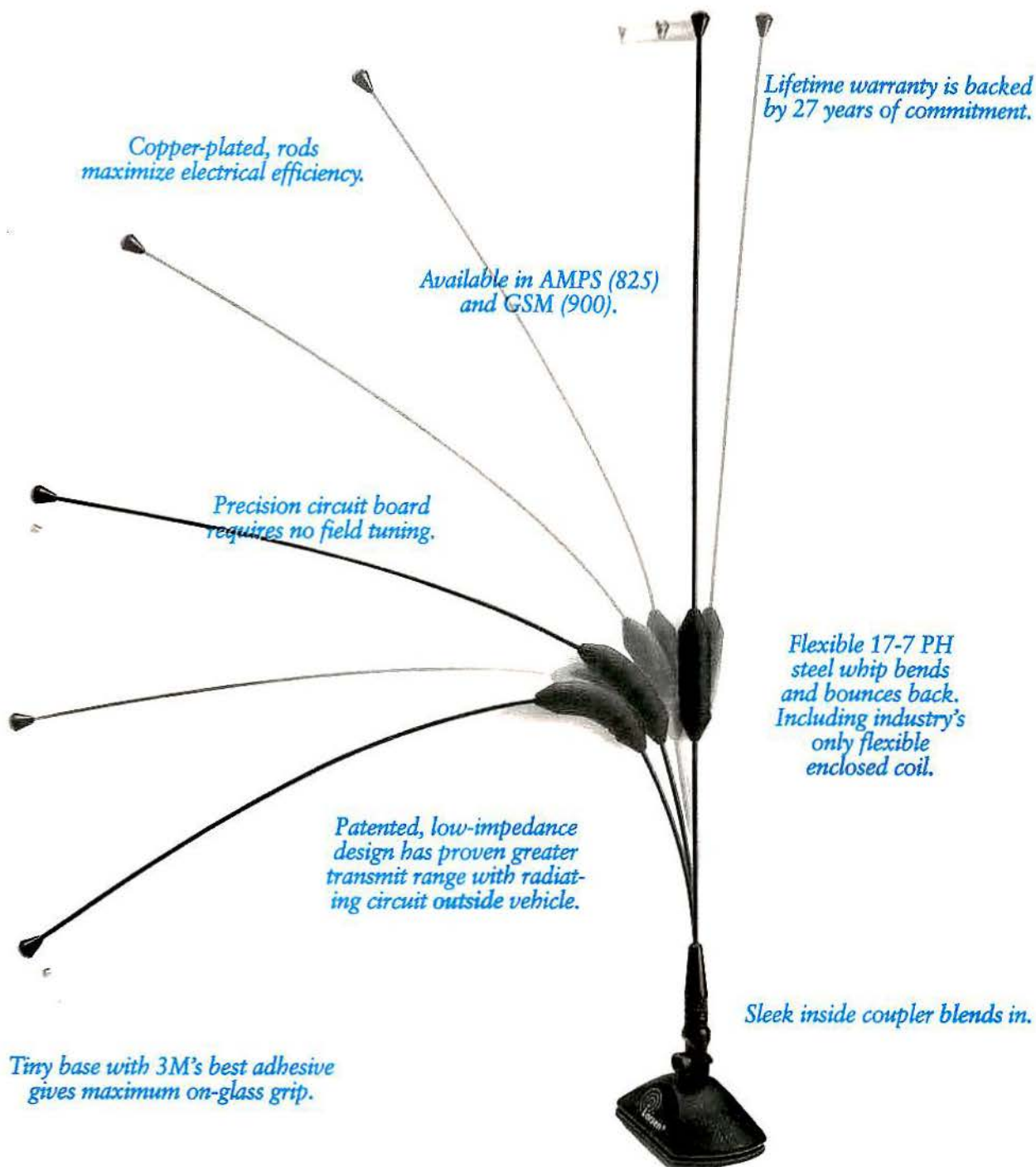


The ULTRA-COM 96DT represents a unique application of console design and microprocessor technology to meet the needs of 4- to 16-channel users, with large-console features at "desktop" cost. Its application of microprocessor technology and ergonomic console design provides all the features found in larger, more expensive systems.

Write for detailed literature and specifications.

MODULAR COMMUNICATION SYSTEMS, INC.

13309 Saticoy St., No. Hollywood, CA 91605 / (818) 764-1333 / FAX (818) 764-1992



*Copper-plated rods
maximize electrical efficiency.*

*Available in AMPS (825)
and GSM (900).*

*Precision circuit board
requires no field tuning.*

*Lifetime warranty is backed
by 27 years of commitment.*

*Flexible 17-7 PH
steel whip bends
and bounces back.
Including industry's
only flexible
enclosed coil.*

*Patented, low-impedance
design has proven greater
transmit range with radiat-
ing circuit outside vehicle.*

Sleek inside coupler blends in.

*Tiny base with 3M's best adhesive
gives maximum on-glass grip.*

No Other On-Glass Antenna Stands Up To Larsen.



For on-glass antennas,
Larsen's state-of-
the-art features
set industry standards. They max-
imize cell system performance.
Increase voice quality. Prevent

dropped calls. And of course, make
happy subscribers.

So call 800-426-1656 or fax
206-944-7556.



Larsen Antennas®
The Clear Choice™

Circle (39) on Fast Fact Card

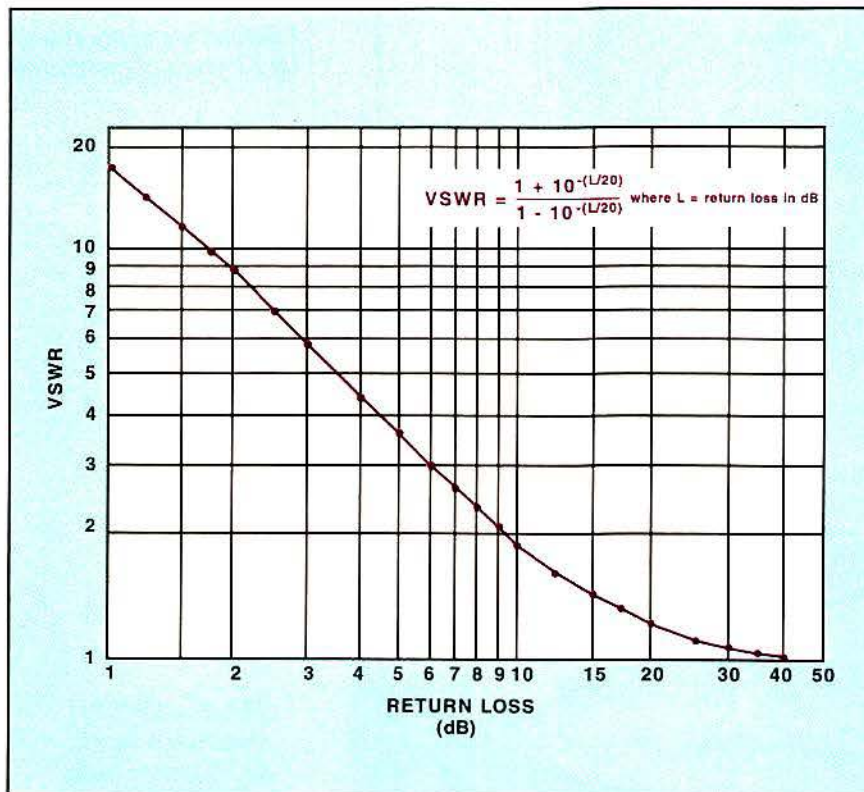


Figure 6. This graph correlates VSWR with return loss. Notice that above 40dB, the VSWR drops so low that any further decrease is of little significance. The equation for converting return loss to VSWR is shown on the graph.

vides a convenient means of converting between return loss and VSWR.

The return-loss bridge can be used to check the degree of mismatch of filters, antennas, receiver inputs, amplifier inputs and isolators—in short, any 50Ω device.

Figure 7 on page 46 shows how a return-loss bridge is used to tune a cavity to optimize the impedance match at the specific frequency in use.

The return-loss bridge can be used as a combiner to combine two signal sources into a single port. (See Figure 8 on page 46 for details.)

When using a return-loss bridge, it is important to be familiar with the specifications and limitations of the particular bridge being used. Be sure to observe the input power limit. Do not apply dc; these are RF devices—low-power RF devices.

Resolution

Another point to consider is the resolution, or directivity, of the bridge itself. You

BEE™

Quality Leather Cases

We're working our hides for you!
Two-way / Cellular / Paging

We stock more quality top-grain leather cases than anyone else in the industry. Our manufacturing techniques match the advanced specifications of the latest in Portable Radio, Pager or Cellular models.

- Immediate delivery from large inventory.
- Two day delivery on set up orders.
- Logo imprinting. ■ Low pricing.

If you're not getting this kind of service ... call today.

Your one-call supplier for Hard Protection and Soft Leather Cases.

BEE Electronics, Inc.
2655 Gardner Road, Broadview, IL 60153
Toll Free: 800/336-3115 Fax: 800/345-2091

INTRINSICALLY SAFE

EM-200IS

If you work around hazardous materials, fire or petrochemicals, you know your communication system must be safe as well as reliable. Our popular Telex Ear-Mike® transducer line already has a well-earned reputation for rugged dependability. Now our new intrinsically safe EM-200IS offers you everything you need to communicate in volatile work environments. Approved by the Nationwide Consumer Testing Institute in accordance with UL-913, the EM-200IS may be used as a system with a growing list of popular intrinsically approved radios. Call or write for complete details.

TELEX

9600 Aldrich Avenue So., Minneapolis, MN 55420
Telephone: 612-887-5530 Fax: 612-884-0043

©1993 Telex Communications, Inc.

Circle (41) on Fast Fact Card

Circle (40) on Fast Fact Card

Suddenly it's a wireless world.



Paging and specialized mobile radio are just two components of the worldwide wireless revolution. This new quarterly magazine explores the full scope of our wireless world. The players. The technology. The market opportunities.

WIRELESSTM **WORLD**

The New Quarterly Information Source from
Mobile Radio Technology and Cellular Business.

Premieres First Quarter 1994

*Manufacturers: contact your
Mobile Radio Technology Marketing Manager
for advertising information.*

For subscription information, circle 42 on reply card.

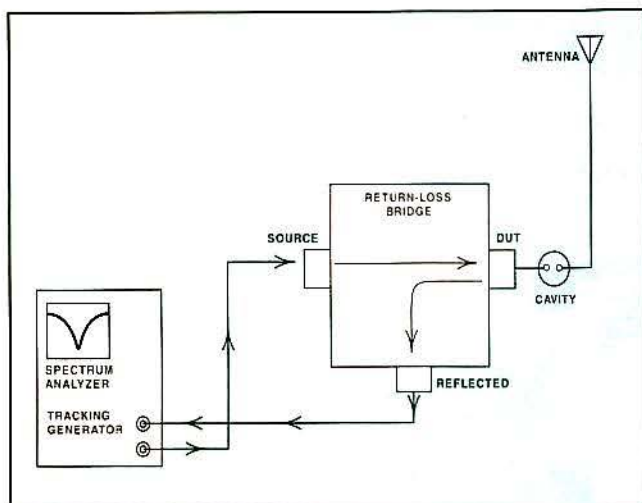


Figure 7. A cavity filter can be tuned using the return-loss bridge method. Although the spectrum analyzer-tracking generator could be used to plot the cavity's passband response, the passband would be very broad in comparison to the bridge method. The bridge method allows precise cavity tuning at the specified frequency for the optimum match and optimum power transfer.

cannot measure return loss beyond the resolution of the bridge itself. For example, if the directivity of the bridge is 35dB, you cannot measure a return loss greater than 35dB.

For the sake of accuracy, measurements should be well below the specified directivity limits. Very low reflections from the DUT may be masked by the reflections within the bridge itself.

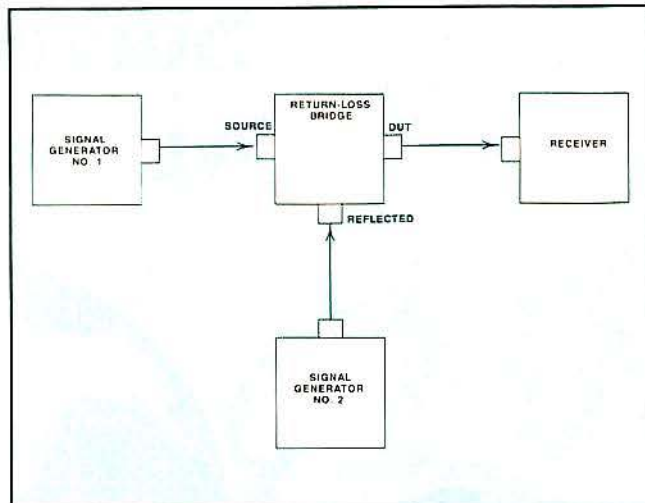


Figure 8. Although the return-loss bridge was not designed for this particular application, it makes an excellent combiner. Here it is used to combine outputs from two signal generators to the input of a common receiver. Such a setup is used for checking the adjacent channel selectivity and desensitization figure of a receiver. The return-loss bridge provides excellent isolation between the two signal generators.

If it is necessary to measure higher return-loss figures you will have to use a higher-quality return-loss bridge, that is, one with better directivity. At higher frequencies and higher return-loss measurements, the connectors also can become a limiting factor.

For practical purposes, 35dB is a very good return-loss figure. It equates to a VSWR of about 1.04:1. A return loss of 45dB equates to a VSWR of about 1.01:1, which is a higher return loss and a lower VSWR than most technicians ever will be concerned about.

Frequency range is another consideration. The bridge is only accurate over its specified frequency range. The frequency range of most bridges is clearly marked on the housing. Be sure to observe it.

It is hoped that this column will serve as a primer on return-loss bridges. It is impossible to present all of the practical applications in this space. Additional information is available on request from the manufacturers of these devices.

One such source is Eagle Wichita, P.O. Box 9446, Wichita, KS 67277; 316-942-5100. Time spent learning how to use these bridges in practical applications is time well spent. It might save you much more time in the future.

Radius® GP 300 PORTABLE TWO-WAY RADIO

We stock the Radius line in depth, including the exciting new GP 300. Most orders shipped the next day. Call us, we would like to show you how good our prices and service really are.

RADIUS IN STOCK:

- P 10 • P 200 • M 200
- P 50 • GP 300 • M 400
- P 100 • M 100



2050 S. Bundy Drive
Los Angeles CA 90025
Toll Free: 1-800-877-7979
Or: 1-310-820-1234
FAX: 1-310-826-7790



ALSO IN STOCK:

AEA DATA
AOR
ASTRON
BECKMAN
BIRD
CENTURIAN
CUSHCRAFT
FANON
HENRY
HOXAN
ICOM
JABRO
KANTRONICS
LARSEN
MAXON
OPTO
PIPO
TEMPO
UNIDEN
YAESU



NABER accepts 1994 Technician-of-the-Year nominations

The National Association of Business and Educational Radio (NABER) is accepting nominations for the Technician-of-the-Year award, sponsored by NABER's Association of Communications Technicians (ACT). The award recognizes the role technicians play in the industry by honoring the technician who has exhibited the most outstanding effort in the performance of duties. Each nomination will be evaluated on customer satisfaction, performance, professionalism and teamwork. All candidates must be actively employed in the mobile communications industry.

Nominations are held in confidence and must be submitted to NABER no later than Jan. 31, 1994. To receive more information or a nomination form, call Jan Jensen at 800-759-0300.

IDA, Pacific Circuit Design join in marketing venture

IDA, Fargo, ND, and Pacific Circuit Design, Sidney, British Columbia, have entered into a joint venture. IDA will be the only company to market Pacific Circuit Design's line of fleet management and scrambling products. Plans are underway for joint development of some new products.

Pittencrieff acquires three SMR providers

Pittencrieff Communications, Abilene, TX, has acquired the assets of All-Comm Communications, Albuquerque, NM; Caprock Radio Telephone, Lubbock, TX; and the wireless communications division of American Communications, Corpus Christi, TX. The acquisitions expand Pittencrieff's coverage area into the Texas panhandle, including the cities of Lubbock and Amarillo and give the company increased market penetration in Corpus Christi and in the central and northern parts of New Mexico.

Century Telephone Enterprises, Celutel execute merger agreement

Century Telephone Enterprises, Monroe, LA, and Celutel, Annapolis, MD, have executed a merger agreement for Century to acquire all of the capital stock of Celutel. The transaction is subject to preparation of a registration statement, approval of Celutel shareholders, FCC approval and the fulfillment of other closing conditions.

CenCall to purchase Motorola SMR properties in 17 states

CenCall Communications, Denver, has signed an agreement in principle with Motorola, Schaumburg, IL, to purchase Motorola's 800MHz specialized mobile radio (SMR) businesses, systems and licenses.

CenCall, which operates or has agreements in principle to acquire radio dispatch services in Colorado, Washington, Oregon, Idaho, Oklahoma, Kansas, Missouri, Wyoming, Minnesota, Arizona and New Mexico, will be assigned Motorola's frequencies in these states. CenCall also will be assigned Motorola's SMR assets in North Dakota, South Dakota, Montana, Iowa, Nebraska and southern Illinois.

Motorola will receive 11.5 million shares of CenCall stock for its SMR assets, and CenCall has agreed to sell to Motorola for \$12.5 million a warrant to

purchase 4 million additional shares of common stock at an exercise price of \$64 per share the first year; \$65 in the second year; \$75 in the third year; \$85 in the fourth year; and \$95 in the fifth year.

In the agreement, the companies said they would discuss a plan for the migration of existing analog dispatch customers to digital service. Included in the agreement are provisions where CenCall will agree to use Motorola MIRS infrastructure and subscriber equipment to construct and operate MIRS systems for SMR and digital mobile phone systems. By a mutually acceptable date, Motorola will complete necessary steps to establish acceptable, alternative sources of MIRS equipment.

The agreement is subject to regulatory, board and CenCall shareholder approvals and will be finalized at a later date.

Qualcomm to purchase assets in Motorola's CoveragePlus business

Under the terms of an \$8 million agreement, Qualcomm, San Diego, and Motorola, Schaumburg, IL, will work together to convert existing CoveragePlus and DriverLink/24 customers to Qualcomm's OmniTracs system.

Motorola and its dealers, agents and value-added resellers will discontinue selling products and systems designed to operate on the CoveragePlus network. Qualcomm will sell Motorola its

OmniTracs mobile satellite communications terminals to replace terrestrial CoveragePlus units. The company also will sell messaging and other services to those Motorola customers who convert to the OmniTracs system.

Comdata, Brentwood, TN, is a distributor of the CoveragePlus system and is expected to become a distributor for Qualcomm's OmniTracs.

Harris to modernize Pennsylvania Transit Authority communications system

Harris Electronic Systems division, Melbourne, FL, has been awarded a \$10 million contract to modernize the 20-year plus communications system used to link more than 1,100 transit vehicles in Allegheny County, PA. Harris will provide a countywide communications system for a fleet of as many as 900 buses and 115 Port Authority police, maintenance and super-

visory vehicles.

Harris will integrate and install the 450MHz simulcast radio and transit communications system for a population of 1.4 million. Ericsson GE, Lynchburg, VA, will supply mobile and portable communications equipment. Work on the contract should be completed by winter of 1994.

Cycomm to demonstrate linear modulation technology

Cycomm, Fairfax, VA, the U.S. manufacturer's representative for Securicor PMR Systems, Bath, United Kingdom, has received the first linear modulation (LM) radio system from Securicor and will begin to demonstrate this technology immediately. The LM technology provides the first capability for high speed data transmission (9.6kb/s) in a very narrow band (5kHz) radio channel. The demonstration system will oper-

ate at 220MHz, but the technology can be applied to any of the land mobile radio bands.

Demonstrations will be made for mobile radio users, radio spectrum regulators and coordinators, 220MHz licensees, U.S. radio manufacturers who may wish to license the technology or manufacturing rights and organizations that may wish to develop software for mobile high-speed data applications.

EDACS digital SMR network to serve seven states

Racom, Marshalltown, IA, and Ericsson GE's Land Mobile Radio Business, Lynchburg, VA, have agreed to implement a multi-site EDACS digital SMR network. The system will eventually comprise more than 200 sites, covering Iowa, Minnesota and Nebraska, as well as portions of South Dakota, Wisconsin, Illinois and Missouri, serving a population of 10 million. Racom will own and operate the system, providing customer service, site management, end-user sales and maintenance. Ericsson

GE will provide the fixed sites, network switch and user equipment.

Private dispatch networks, both voice and data, and mobile phone service will be offered on a fast-access, area-wide basis. Locations requiring high capacities will be upgraded to digital RF using time division technology when loading demands. Ultimately, subscriber information will be dual-mode, employing both FM analog and digital access.

PacTel Teletrac to provide fleet management in Houston

PacTel Teletrac, Inglewood, CA, has signed a contract with the Houston Metropolitan Transit Authority to provide the Fleet Director fleet management system. Initially, the Authority will use Fleet Director to manage its MetroLift paratransit fleet.

MetroLift offers free, door-to-door transportation to more than 25,000 disabled residents in the Houston area. After a two-month pilot program, Fleet Director transceivers were installed in all 139

MetroLift vehicles, including mini buses, taxis and wheelchair-accessible vans.

The system allows dispatchers to track the vehicles on a computer screen for more efficient scheduling, and the in-vehicle message terminals speed up service by allowing the driver to communicate with the dispatcher without having to stop at pay phones. The driver can press the alert button from the vehicle or by remote switch to silently signal the dispatcher in case of an emergency.

US West to sell paging division

The Westlink Company, San Diego, has agreed to purchase the assets of US West Paging, Englewood, CO. The transaction is subject to FCC and regulatory approval in some states, as well as certain other contingencies, but it is expected to be completed in the second quarter of 1994.

"We intend to place more emphasis on two-way voice and data technologies, including cellular and personal communications services (PCS)," said Richard D. McCormick, US West chairman. "This sale will allow us to provide greater focus around our core business strategies."

Robert P. Meinzer Jr., former president of US West Paging and vice president of sales in the Western region for US West Cellular, now serves as chairman of The Westlink Company. The company was formed to purchase the assets of US West Paging.



TNF-200 Tuneable Notch Filters 1.5-850 MHz



Features

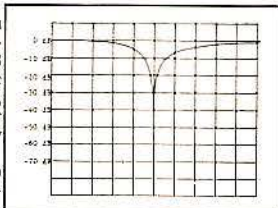
- Deep notch to 35 dB
- Low VSWR
- Low loss: <0.5 dB
- Passes to 2.4 GHz
- Up to 25 watts power
- Rugged construction
- Cost : low as \$9.10

TNF-200 is a family of nine models notch filters, covering 1.5 to 850 MHz., with low insertion loss over an extremely wide bandwidth. For example the 30 MHz version passes >500 MHz or 13 times the notch frequency. This is superior to cavity filters, which also are much larger and more costly. Most of the models cover more than one octave using one easily tuned adjustment. High Q circuitry assures a deep notch and low insertion loss (less than 0.5 dB at 1.0 GHz) thus making EAGLE filters your best choice.

These filters are useful for high performance spectrum measurements by providing a 20 to 30 dB improvement of analyzer dynamic range. In harmonic measurements, for example, simply notch the carrier and remove some attenuation to view low level harmonics.

Notch filters can also be used to eliminate or identify off-band interference in communication systems.

The TNF-200 filters are in stock for immediate delivery! But EAGLE is more than notch filters. We provide LC filters to 1.0 KW, Power Combiners, Diplexers, Triplexers and Return Loss Bridges.



Need More Information?

Call or Write Today!

EAGLE
WICHITA

Phone Voice: (316) 265-2050
Fax: (316) 265-2255
P.O. Box 9446 Wichita, KS 67277

Circle (45) on Fast Fact Card

Solar/Cell Batteries



For all your remote power needs:



**SOLAR ELECTRIC
SPECIALTIES CO.**
P.O. Box 537 Willits, CA 95490

Order Hotline 800-344-2003

Circle (46) on Fast Fact Card

**THIS
Is Where
Telecommunications
Professionals
In The World's
Leading Energy
Companies
ARE GOING.**

ENTELEC '94

**MARCH 6 thru 9, 1994
San Antonio, Texas**

FOR MORE INFORMATION

contact Martha G. Fike, CAE
ENTELEC Executive Manager

214.235.0655

FAX: 214.235.0653



Calling all cars!

By Robert H. Schwaninger Jr.

Having recently attended the tutorial on the Intelligent Vehicle Highway System (IVHS), for which the FCC provided space, if not much input, I am struck with the knowledge that no matter what land mobile radio competition is touted, the game ain't over till the FCC sings.

If you review the system architecture touted by the U.S. Department of Transportation (DOT) in concert with IVHS America and apply a little market sense, the problems the FCC faces in helping to implement IVHS make its "laryngitis" understandable.

IVHS refers to electronic and RF systems used to provide route data, fleet tracking, electronic toll collection, emergency response, vehicle anti-theft protection, AVI, AVM, LMS, GPS and IOUs for spectrum.*

The last tri-letter designation probably is the one giving the FCC some angina. Representatives of the agency said little during the IVHS tutorial because the FCC probably is not ready to make any long-term spectrum commitments to IVHS. To be fair to the FCC, it appears as though IVHS proponents have not made up their minds about spectrum requirements, either. Proponents include universities, local governments, state governments, private industries, consumer groups, professional societies, international societies, industrial groups and at least three federal agencies.

Trying to find a consensus among these participants must be like herding cats. One must, therefore, properly doff a hat to IVHS America, which appears to be moving these elements forward in a somewhat similar direction.

A quick glance at the shopping list of potential services exposes both opportunities and problems. IVHS America and DOT

would like to provide to the public the following services:

(1) Pre-trip travel information using hand-held portables, and at-home systems and kiosk traveler information.

(2) En route driver advisories which, one may presume, would be a one-way service perhaps using FM subcarrier frequencies or other alternatives.

(3) Route guidance systems, including in-vehicle navigation systems.

(4) Electronic payment systems that automatically collect tolls and, perhaps, parking fees.

(5) Electronic clearance of commercial vehicle credentials.

(6) Automated roadside safety stations

that provide overspeed warnings and sensor inspection of brake condition for commercial vehicles.

(7) Commercial fleet management, including the use of geopositioning satellite service to perform vehicle location and computer-aided dispatching for trans-

it systems.

(8) Emergency notification and personal security, including electronic placarding for the transportation of hazardous materials.

(9) Collision-avoidance systems that provide adaptive cruise control and warning systems.

That's just what they've come up with so far!

It's no wonder that the problem associated with identifying, securing and integrating the use of the radio spectrum to develop and deliver these services is causing some controversy and questions.

These systems' proponents claim that the services might be brought to the public by using existing spectrum allocations and technology. In the amount of time it takes to utter this claim, doubt rushes in.

One of the goals of IVHS is to fully integrate the services across the country. How this will be accomplished without at least one, if not several, nationwide spec-

... I am struck with the knowledge that no matter what land mobile radio competition is touted, the game ain't over till the FCC sings.



GE RADIOS AT WHOLE- SALE PRICES.

- ★ We will meet or beat any published price.
- ★ The largest GE dealer in N. America
- ★ Rush Delivery in the U.S., Canada & Mexico
- ★ We buy used & take trade-ins on GE Two-Ways
- ★ FREE sales & service support



1-800-336-6825



Hrs.: Mon. thru Fri. 8 A.M. to 7 P.M. E.S.T.
Two-Way Wholesale Distribution
3512 Cavalier Dr. • Ft. Wayne, IN 46808

Circle (48) on Fast Fact Card

*AVI is automatic vehicle inspection.

AVM is automatic vehicle monitoring.

LMS is location monitoring system.

GPS is Global Positioning System.

IOUs is politics.

Schwaninger, MRT's regulatory consultant, is a partner in the law firm of Brown and Schwaninger, Washington, DC.

trum set-asides is unknown.

Somehow, the services are to be delivered using some combination of FM and TV subcarriers, personal communications services (PCS), cellular telephone, UHF repeaters, 220MHz private land mobile radio, specialized mobile radio (SMR), microwave beacons and high microwave systems operating at 5.8GHz.

IVHS America is contemplating whether to propose to the FCC that a separate IVHS radio service be created, perhaps using frequencies below 800MHz that could be reassigned as part of spectrum refarming.

The participants already are battling over the 902MHz-928MHz band. The electronic toll industry wants to share the spectrum with LMS. The LMS service providers would prefer to have the band to themselves, excluding the incompatible electronic toll operators and amateur radio stations from operating in the band. Even so, LMS operators cannot decide whether each LMS system will require 4MHz or 8MHz of bandwidth.

The FCC, meanwhile, wants everyone to be happy.

Speaking of happiness, the services pro-

moted by the IVHS groups will make many companies happy. Just consider the economic benefit of being one of a few licensees to deliver one of the core services to millions of motorists in a major metropolitan area.

During the next 10 years, IVHS services will become one of the fastest growing and most lucrative areas of the telecommunications industry.

You will quickly realize why the largest entities in the telecommunications industry are directing their efforts toward grabbing marketshare. Add to that the manufacturers who are attempting to create standards for equipment production, and the

stakes just went from huge to humongous.

I have to wonder whether the handful of large companies, such as Nextel, who are scrambling to assemble SMR frequencies across the United States to form wide-area systems are looking ahead to IVHS. If, for example, a company could deliver seamless, two-way service across a multi-state region using equipment compatible with other regional systems, that company would be an ideal provider of many IVHS services to the public.

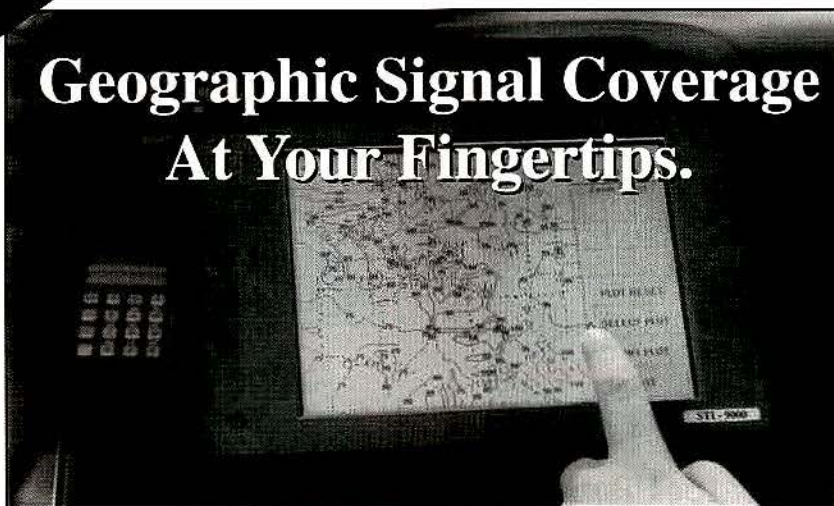
During the next 10 years, IVHS services will become one of the fastest-growing and most lucrative areas of the telecommunications industry. Growth will not be even; services will not be immediately integrated, and opportunities will not be equitably distributed. Instead, the bulk of the benefits will go to the informed and the innovative.

But, given the sweetness of the economic pies to be divided, even a small slice should be quite satisfying.



NEW!

Geographic Signal Coverage At Your Fingertips.



Introducing the STI-9000, a simple, cost-effective system that measures signal coverage for:

Cellular, Paging, Broadcast & Mobile Radio.

The STI-9000 offers:

- Mobile Touch-Screen Control
- Instant Signal Coverage Contour Plots
- Real-Time Measurements Display
- State-of-the-Art GPS Accuracy

STI Survey
Technologies
Incorporated

For more information,
contact Bill Peek at

503-591-5986

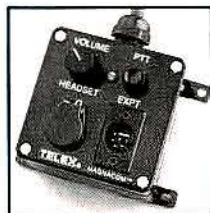
SURVEY TECHNOLOGIES, INC. • 17980 SW SHADYPEAK • BEAVERTON, OREGON 97007 • FAX: 503-591-5986

Circle (49) on Fast Fact Card

Reader's choice

Of all the new products and services in the May 1993 issue, the ones reprinted here generated the most reader requests for additional information. If you missed them the first time, here is your opportunity to acquire more information on them: Just circle the corresponding Fast Fact Card number on the card found in the back of this issue and mail the card to us.

Stand-alone, weather-proof station connects to fire engine radio



The MAG-PPR pump panel remote is a stand-alone, weather-proof station which connects directly to a fire engine's radio.

The MAG-PRI portable radio interface enables

firefighters on location to monitor their portable radios without interruption. When the firefighter leaves the fire engine, the headset is unplugged from the vehicle intercom and plugged into the MAG-PRI, which is connected to a portable radio. Both units are additions to Telex's Magnacom modular emergency and utility vehicle intercom system.

Circle (500) on Fast Fact Card

Data radio provides high-speed serial data transmission

The FM 96 data radio from IWL Communications provides fast, reliable data transfer. It contains a UDS half-duplex wireless modem that transmits or receives synchronous or asynchronous serial data at 9,600 bps over 450MHz-

470MHz. Features include RS-232 interface and 2W UHF or 4W UHF. The unit measures 6.20"L x 2.10"W x 1.52"H.

Circle (501) on Fast Fact Card



Mobile, portable radios feature PC field programmability

The Monogram series of mobile and portable radios from Ericsson GE handles all the basic two-way radio functions at an affordable price. The Monogram mobile is a 16-channel conventional radio in VHF and UHF frequencies with 40W transmit power, dual-priority scan, PC field programmability, CTCSS and DCS. The Monogram portable features 5W or 1W power at a flick of a switch, PC field programming, 10 channels and channel-busy lockout.

Circle (502) on Fast Fact Card

Police/Fire Comparator Display			
East Police:	West Police:	Central Police:	Sequoyia Police:
Indian Hill	Miami Heights	Williamson Rd	Comm Center
Williamson Rd	Calhoun Hall	Greenhills	Indian Hill
Glendale W.T.	Cheviot	Engineers	Miami Heights
Comm Center	Comm Center	Glendale W.T.	Calhoun Hall
Loveland W.T.	Mt. Echo	Calhoun Hall	Greenhills
Glendale W.T.	Miami W	Comm Center	Loveland W.T.
Greenhills	Greenhills		Mt St Joseph
Engineers	Cleves		Succelline
Glendale W.T.	Fernald		Miami W
Calhoun Hall	Prov. Hosp.		Glendale W.T.
	Mt St Joseph		Marionmont
	Engineers		Millard
	Miamitown		Cheviot
	Harrison		Cleves
			Williamson Rd
			Prov. Hosp.
			Fernald
			Mt. Echo
			Engineers
			Miamitown

Remote Comparator Display

The Smartswitch II™ Remote Comparator Display monitors and controls voting receiver systems on a personal computer or console. It can be used locally or remotely with leased-line or dial-up modems.

Now you can *get control* of your voting system.



Combined Technologies, Inc.
(513) 595-5900

Circle (50) on Fast Fact Card

ARE YOU IN CONTROL OF YOUR COMMUNICATIONS—

Keep Your System

**SMALL
EFFICIENT
INEXPENSIVE**

Systems Start
As Low As
\$2395

These devices allow regular telephone service to be extended from or to remote sites.

When Communication Is Critical—

A Wireless Telephone System Is A Must

Available Immediately

Send for **FREE** copy of DataCom's full line of Radio Products.



DataCom Systems, Inc.

520 No. 30th • P.O. Box 3485 • Quincy, IL 62305 U.S.A. • Tel.: (217) 222-0160 • Fax: (217) 222-0912

Circle (51) on Fast Fact Card

VHF/UHF radios provide trunking without controllers, home channels



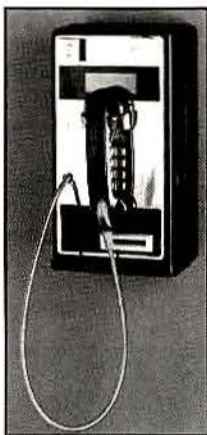
The 40W SLV40ET and 25W SLU2ET series ETrunk-equipped trunking radios are compact (1.5" x 5.75" x 7"), 16-channel mobile radios with built-in CTCSS and DCS. When used with a repeater and tone panel, the ET series radios give the system operator and end-user an 800MHz trunked system without costly controllers, home channels or interlinking of sites. The radios are the result of combined efforts by Relm Communications and ETrunk Systems.

Circle (250) on Fast Fact Card

Correct change no longer required with debit cellular pay phone system

Technology Service Group offers a debit cellular pay phone system for public and private use. The phone is activated by debit cards imprinted with magnetic strips, thus eliminating the need for cash collection and reducing the motivation for vandalism and theft. The non-intelligent magnetic debit cards are the size of an average credit card, range from 7 to 10 mils thick and are made from polyester or paper.

Circle (251) on fast Fact Card



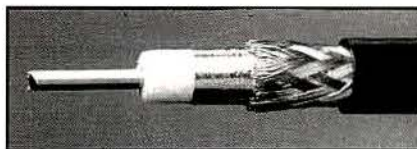
Belt loop radio case swivel attaches from any direction

The AWedge wedge swivel from A.W. Enterprises offers the convenience of attaching a radio case to a belt loop from any direction. The wedge is compatible with most "invert and insert" swivel carrying cases. Use of the swivel eliminates the

need to turn the radio upside down to attach it and reduces the chance of accidentally dropping the radio. The AWedge swivel accessory comes in three models: a swivel belt loop, a female (loose) swivel with no loop, and a male swivel (loose) with no loop. All three AWedge swivels are made of stainless steel.

Circle (252) on Fast Fact Card

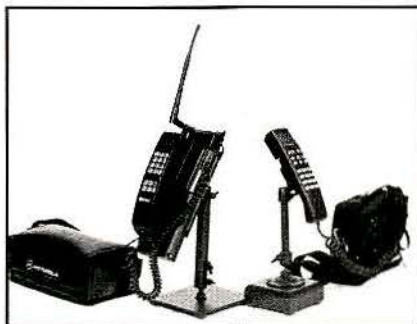
Low-loss cable for base stations has 100% foil anti-leakage shield



Ultralink 93605 low-loss cable for base stations from Cushcraft/Signals has a solid center conductor for better conductivity and low loss (4.19 dB per 100 feet at 900MHz). The foam dielectric promotes low loss and prevents water migration. The 100% foil shield eliminates RF leakage and decreases loss. The cable features 95% braid coverage for connector attachment and grounding.

Circle (253) on Fast Fact Card

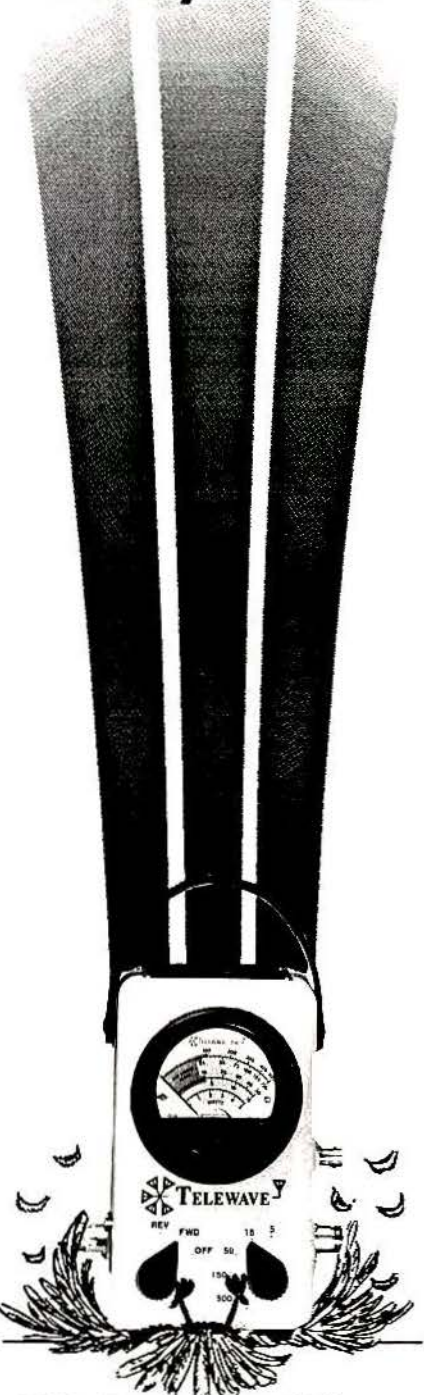
Mounting kits stabilize bag phones in vehicles



Model 9BPMT-1 mounting kit from SMC Electro-Mount is designed to mount and stabilize the Motorola 2600 bag phone and the OKI 891 mini-transportable phone for use in any vehicle. The mount plate attaches to the underside of the transceiver and does not interfere with the use of optional battery eliminators. The mating plate can be attached to any of SMC's standard pedestal mounts. The 9NOBP-1 model, for Nokia bag phones, consists of a mount plate with a magnetic bar that mounts to any of SMC's standard pedestals and provides a secure method of positioning the handset for in-vehicle use.

Circle (254) on Fast Fact Card

Telewave's Broadband RF Wattmeter is rapidly becoming a new Industry Standard!



We're Crushing the Competition!

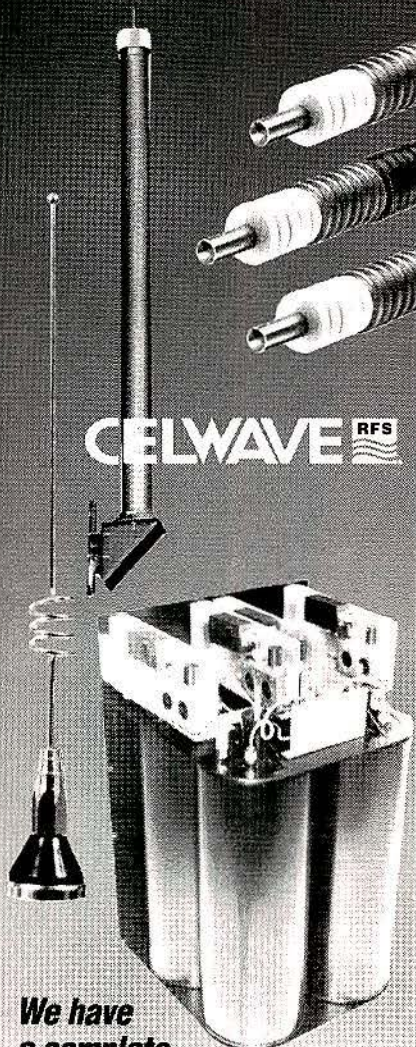


Telewave, Inc.



Circle (52) on Fast Fact Card

Santa Fe Distributing has all your Cable, Combining, and Antenna needs!



**We have
a complete
line of CELWAVE:**

- Base Station Antennas
- Mobile Antennas
- Duplexer/Combiner
- Cable

SFD

SANTA FE Distributing, Inc.

9640 Legler Rd., Lenexa, KS 66219

913-492-8288

FAX: 913-894-2136

1-800-255-6595

Circle (53) on Fast Fact Card

New products

Enhanced radio operating software makes functions more user-friendly

Syn-Tech II two-way radio with enhanced PS-3 microprocessor software are available from Midland LMR. The software improves function selection, making it easier to use the scan, priority, selective call and talk-around features. The Syn-Tech PS-3 radios are available in mobile, base station and repeater models in all the common land mobile frequency bands. Options include a 12-character alphanumeric LCD with a three-character group display, switchable simplex and duplex operation, high-security scrambling and



built-in vehicular repeater.

Circle (255) on Fast Fact Card

Software module updates terrain analysis package for transmitter sites

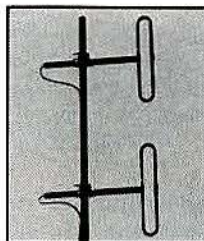
An RF design software model from Softwright uses the Longley-Rice method of predicting received field strength. The Longley-Rice method accounts for terrain,

surface refractivity, soil conductivity, climate, effective antenna height and antenna elevation pattern. The software module is integrated into the Terrain Analysis Package (TAP) system for extensive modeling of RF coverage studies for land mobile, cellular, paging, broadcasting and microwave radio systems. The PC-based TAP system can be used to design or evaluate existing or proposed transmitter sites and hardware configurations before construction.

Circle (256) on Fast Fact Card

Exposed dipole array antennas handle 500W, allow adjustments

Exposed dipole array antennas for the 138MHz to 174MHz band and the 216MHz to 252MHz band handle 500W of power. Field adjustments can be made for omni, elliptical or cardioid coverage. Each antenna from Telewave is constructed of heavy aluminum, which is welded at the base connection to prevent intermodulation interference. Models include two- and four-bay antennas.



Circle (257) on Fast Fact Card

Tower site directory goes on-line

Dean Brothers Publishing, the publisher of *Fryer's Site Guide*, a directory of towers and sites throughout the United States, offers on-line service to subscribers and advertisers. The on-line service identifies site owners (with telephone numbers), AAT data, radial data, propagation data and population data. Subscribers and advertisers receive an access code to allow them to use the system.

Circle (258) on Fast Fact Card

High-speed, high-resolution counter offers auto-hold, serial data output

A pocket-size, high-speed, high-resolution, hand-held frequency counter from Optoelectronics features 10 user-selectable sample measurement periods (gate times), ranging from 13 milliseconds to 10 seconds with corresponding measurement resolution from 10kHz to 0.1Hz. This allows the M1 Handicounter to perform both ultra-high-speed measurements as well as high-resolution 10-digit measurements. The counter's OE10 high-speed, application-specific integrated circuit is capable of 250MHz direct counting. The M1 covers 10Hz-2.8GHz and has a backlit LCD. The counter comes with rechargeable NiCad batteries and an ac power supply-battery charger. A variety of antennas and probes are available.

Circle (259) on Fast Fact Card



Fax transcripts give confirmation of radio-pager users' messages

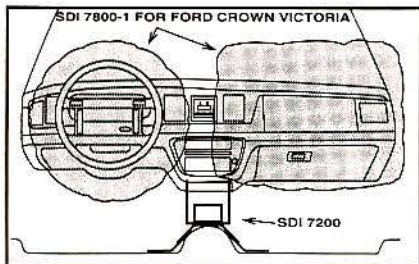
A printed record of incoming pager messages for follow-up or confirmation is available by subscription to a service developed jointly by **TGA Systems** and **MCI Global Messaging Services**. The service uses MCI's enhanced fax services to deliver a log of paper messages to a user's fax machine at a prearranged time.

Paging companies can attach the fax

delivery equipment, developed by TGA Systems, to existing paging systems as an additional part of the network. Each logged message is date- and time-stamped. The system will document any numeric or alphanumeric message sent to the subscriber.

Circle (260) on Fast Fact Card

Templates, mounts aid coexistence of air-bags and comm equipment



Two **Scientific Dimensions** products offer safer installation and use of mobile communications equipment in vehicles equipped with passenger and driver air bags.

The SDI 7800 Safe Zone Templates are replicas of actual air bags from the major automobile manufacturers. Kits come with templates for both sides. The air bags can be inflated and positioned on the dash and steering wheel to reveal the precise available areas for mounting installations. The SDI 7800 series includes

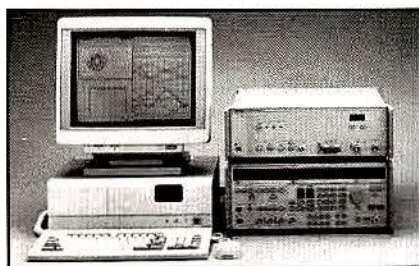


kits for new model Ford Crown Victoria and Taurus sedans and new model Chevrolet Caprice sedans.

The SDI 7200 is an air bag-sensitive console mount for mobile communications equipment. Bolted under the front bucket seats and straddling the transmission hump, the SDI 7200 can carry an MDT on a quick-release base and as many as four communications devices within an adjustable cradle.

Circle (261) on Fast Fact Card

Digital modulation signal analyzer features range of 10MHz-2.7GHz



The ME2627B digital modulation signal analyzer features frequency range of 10MHz to 2.7GHz to test digital cellular and digital cordless telephones.

The unit from **Anritsu Wiltron** analyzes and measures frequency and phase error, modulation accuracy and amplitude envelope. Frequency error is less than 5Hz at 1 GHz; relative amplitude accuracy is ± 0.5 dB full scale to -40 dB.

Circle (262) on Fast Fact Card

Charging accessories available for Sony portable cellular phones

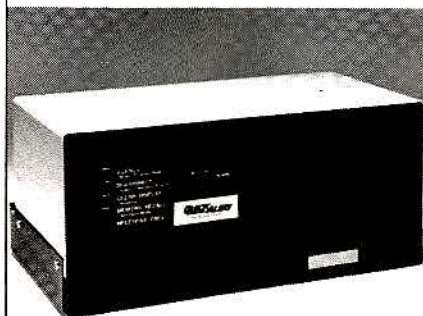
Ora Electronics introduces the Quick Charger/Conditioner model QCC3SNY and the Starter-Kit model SNY3SK for the Sony CM-H333K portable cellular phone. The Quick Charger/Conditioner can charge NiCd rechargeable batteries in one hour or less and can condition batteries to restore lost capacity. The Starter-Kit contains accessories such as the power cord, NiCd battery and a leather case.

Circle (263) on Fast Fact Card



QUICK-ALERT

Alphanumeric Alarm Paging



QUICK-ALERT system can be added to any alphanumeric capable paging terminal.

- **Increase Alpha Sales**
- **Reduce Churn**
- **New Revenue Source**

DIRECT RS232 TAP ENTRY

REMOTE MODEM TAP ENTRY

SIMPLE INSTALLATION

SOME APPLICATIONS

- equipment monitoring
- refrigeration failure
- power failures
- over/under temperature
- summons buttons

HOSPITALS—INDUSTRIAL
—MUNICIPALITIES

FOR MORE INFORMATION CALL

1-800-645-4595

Canada 403-423-2020

TELEMESSAGING DEVICES, INC.

FAX 919-850-0166

3029-115 Stonybrook Dr., Raleigh, NC 27604

Circle (54) on Fast Fact Card

New products

Dual control unit option allows alternate site transceiver control



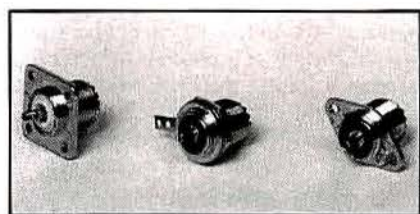
A dual control unit option has been developed by Teletec for the Omni mobile transceiver product line. The option allows two Omni control units to be used with any Omni transceiver configuration and allows the user to operate the radio from two locations alternately. A simple key sequence initiates a transfer of control between locations. The option consists of a second Omni control unit, a switch assembly and ultra-slim control cable. The option is available for the IQ1000, IQ2000, EMS1000 and EMS2000 transceiver models.

Circle (264) on Fast Fact Card

Female UHF connectors offer front-, rear- and flange-mounting to chassis

RF Industries offers five female UHF chassis connectors: RFU-521 and RFU-521-ST are four-hole, flange-mounted connectors; RFU-523 and RFU-524 are rear- and front-mounted, bulkhead-style connectors; and RFU-522 is a two-hole, diecast, flange-mounted UHF chassis socket.

Circle (265) on Fast Fact Card



Two-way, portable FM transceiver puts high-RF power in the pocket

Motorola's Visar FM transceiver shrinks two-way technology into an 11-ounce, 8-cubic-inch "shirt pocket" unit while maintaining the power of larger portables. The Visar features 16 conventional channels and RF power output of 5W in the VHF band and 4W in the UHF band. A 3W model is also available for the 800MHz shared trunked band. The unit



features a speaker that handles 500mW of audio and a compact 7.5V nickel-metal hydride battery power supply. The alphanumeric and channel number LCD is illuminated, as are the numeric keypads, for nighttime and surveillance applications.

Circle (266) on Fast Fact Card

Unit adds lines to paging terminal

Hark's Tap 200 alphanumeric input expander provides 24 additional inputs per computer port and allows TDD access without dedicating additional phone lines or modems. The Tap also supports IXO protocol on its output.

Circle (267) on Fast Fact Card

ATTENTION TWO-WAY DEALERS Join Photocomm's PowerUp! Dealer Network

Direct from North America's largest solar electric systems and component manufacturer, Photocomm introduces PowerUp!, a dedicated support and service dealer program, specially tailored to meet the needs of the two-way radio dealer. PowerUp! today and profit from the growing need for remote power systems and components.

- No Buy In
- Rapid Response Hotline
- Same Day Shipping
- Friendly Support

Components:

Solar modules
Support structures
Batteries
Regulators
Enclosures
Wire and cable

PHOTOCOMM INC.

The Wireless Power Company

Call Today!
1-800-223-7975

Systems:

SUN PAK®
SOLARADIO®
TELEMETRY
ONE®
DC BACKUP

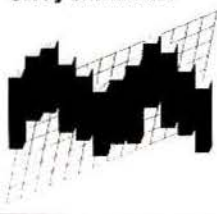
Ask for the "PowerDesk"
to receive your PowerUp! Dealer Kit

Circle (55) on Fast Fact Card

Tired of fighting ac power system problems? Get the answers you need.

AC Power Systems Handbook

Jerry C. Whitaker



• 330 pages

• 200+ illustrations

Topics include:

- AC transients
- Lightning effects
- Grounding
- Power distribution
- AC system design
- Standby power
- Power conditioning
- Safety

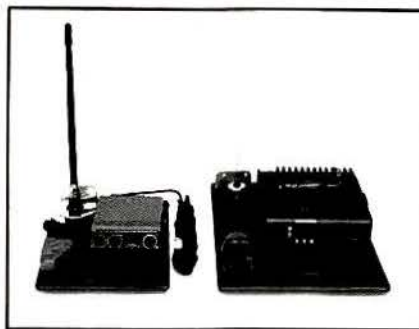
Written by Jerry C. Whitaker, an authority on ac power system design and transient suppression.

From CRC Press and the *Intertec Information Age Catalog*, **AC Power Systems** is an authoritative handbook that explains what you need to know to protect electronic systems from power outages, transients, and related disturbances.

To order call 1-800-543-7771
Catalog #CT-714 \$39.95

Conversion kit offers alternative to dash-mounting mobile radios

Destin Thomas Products' BoardMount is a transportable conversion kit for dash-mount mobile radios and CBs. BoardMounts, which are made of solid-black molded polyethylene, come in three sizes. The 7/16"-thick mount is installed with a custom accessory kit and the radio's standard bracket and hardware. Accessory kits include screws, rubber feet, cigarette lighter adapter and a two-position magnet mount antenna holder. No hard installations into vehicles are needed, although variations are possible. The carrying handle allows for easy movement from vehicle to vehicle. BoardMount can be secured to the vehicle with cable locks run through the handle. The mount with at-



tached radio can be hidden under a seat or removed from the vehicle after hours to discourage theft.

Circle (268) on Fast Fact Card

Software provides alphanumeric link between desktop computer and pager

The Advise software package from Motorola allows users to send alphanumeric messages via modem to the Advisor pager. Available in both Apple and IBM PC-compatible versions, Advise features a directory that can store the pager numbers for as many as 50 subscribers of a single carrier system. To use the system, the

person wishing to send the page types the alphanumeric message into the computer and dials the subscriber's Advisor pager number via the modem. The message is sent to the carrier terminal, which forwards it on to the subscriber's Advisor pager.

Circle (269) on Fast Fact Card

Paging system offers flexibility in message format, connections



The VS 2100 desktop paging system signals as many as 500 pagers with alphanumeric, numeric only, tone-only, or tone-and-voice messages. The system, offered by Visiplex Communications, operates from an 8" x 5 1/2" keyboard console that displays programming functions and data on an LCD. Eight programmed full-text alarm messages may be initiated from con-

tact points connected to the console. Sensors fit machines, security systems, emergency call points, HVAC components, and industrial switching devices

Circle (271) on Fast Fact Card

Retractable antenna replacements offered for portable cellular phones

Replacement retractable antennas from Advanced Fox Antenna are available for portable cellular phones. The flexible antennas are manufactured to the same specifications as OEM equipment. The antennas are available for every brand of phone.

Circle (271) on Fast Fact Card



INTERFERENCE LOCATION



- ★ 50 to 1000 MHZ
- ★ Stuck Microphones
- ★ Cable TV Leaks
- ★ Jammed Repeaters & Cell Sites



New Technology (patented) converts any VHF or UHF FM receiver into a sensitive Doppler shift radio direction finder. Simply plug into receiver's antenna and external speaker jacks. Models available with computer interface, synthesized speech, fixed site or mobile - 50 MHz to 1 GHz. Call or write for details.

DOPPLER SYSTEMS, INC.

P.O. BOX 2780 (602) 488-9755
CAREFREE, AZ 85377 FAX (602) 488-1295

Circle (56) on Fast Fact Card

BATTERY PROBLEMS??

Our customers agree that the RAMSystem is the most effective ANALYZER on the market!



BATTERY PRO

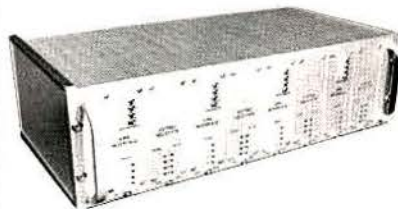
Call before you invest ...

**BatteryPRO
Centres Inc.
P.O. Box 160
Black Diamond,
AB Canada
TOL 0H0**

In
North America
call
1-800-661-9401
or Fax
(403) 933-3233

Circle (57) on Fast Fact Card

SIGNAL-TO-NOISE Voting Comparator



Improve coverage by
adding receivers

- Expandable to 32 Channels
- Continuous Voting
- 19" Rack Mountable
- Select/Disable Switches for Manual Override
- Can be used with RF Links or Dedicated Lines
- LED Indicators
- Hundreds in Service
- More

— Competitively Priced —

For more information call or write:

Doug Hall Electronics
Voter Dept.
815 E. Hudson St.
Columbus, Ohio 43211
(614) 261-8871

Circle (58) on Fast Fact Card



FEEL APPEAL

A handshake is one of the best ways to evaluate the character of another person.

Likewise, one of the best ways to assess a DTMF microphone is to just grab one and hold it in your hand.

A Zetron microphone has a solid, substantial feel to it. A firm, honest grip. One that lets you know it is designed for heavy-duty operation and just plain, hard work.

A Zetron microphone even gives you a hand with installation. Since a Zetron microphone is powered by the "audio bias voltage" which already exists inside your radio's microphone connector, you don't have to dig around in the radio to find a higher source of power. Just plug in the cord, and you're ready to go. All customization takes place by entering commands on the microphone's keypad!

ZETRON MICROPHONES

- Durable for years of use
- Programmable from keypad
- Easy installation
- Convenient cellular-style dialing
- Choice of cables and connectors

You owe it to yourself to get your hands on a Zetron microphone.

Call today!



ZETRON®

12335 134th Ct. N.E. Redmond WA 98052
Phone: (206) 820-6363 Fax: (206) 820-7031

Circle (59) on Fast Fact Card

Data sheet explains trunking Mobilphones

A two-page data sheet from RTX describes its RTX 9600 series trunking Mobilphones which allow users to make and receive local, national and international calls. The data sheet describes and illustrates the operating features and advantages of the phones.

Circle (300) on Fast Fact Card

Catalog displays cellular accessories

A 20-page color catalog includes Advanced Fox Antenna's range of cellular accessories. "The Cellular Accessories Buyers' Guide" features color photography, specifications, product capabilities, features and benefits. The catalog comes with no Advanced Fox identification, no pricing and a blank second page so that dealers, distributors and carriers may print their own names, addresses and telephone and fax numbers.

Circle (301) on Fast Fact Card

Catalog features communications equipment, accessories

A 32-page catalog offers direct access to accessories, radios and pagers from Motorola, Ericsson GE and Midland to end-users nationwide. Inwave's technicians and programmers can assist with system design, help with licensing and answer technical questions. The company offers a radio rental program for those who need radios on a short-term basis.

Circle (302) on Fast Fact Card

Planning guide discusses the establishment of dispatch facilities

Public Safety Communications Agencies, District and Authorities by John H. "Jack" Atkinson, is a guide for the establishment, initial operation and design of dispatch facilities. The 143-page volume from Dispatch Bookstore includes such chapter topics as organizations of the agency, agency policy manuals, initial training, dispatching center planning and public safety radio systems. Several appendices provide information on classification specifications, sample personnel policies, purchasing policy examples and management performance evaluation forms.

Circle (303) on Fast Fact Card

Brochure describes economy surge suppressers

A four-page color brochure from Tripp Lite details economy surge suppressers. Models range from low-cost to deluxe and specialty. The brochure explains the benefits of diagnostic circuitry, ac power problems and the Ultimate Insurance guaranty, which protects connected equipment against surge damage or lightning strikes for life.

Circle (304) on Fast Fact Card

Catalog covers coaxial connectors

A 36-page catalog presents RF Industries' range of coaxial connectors, including 150 new items. It offers extensive coverage of BNC, TNC, N, UHF, Mini-UHF, MB, SMB, SMA, SMC and 1/2" and 7/8" corrugated cable connectors. The catalog features more than 750 coax products, including cable assemblies, connector kits and Unidapt and Celludapt universal adapter products.

Circle (305) on Fast Fact Card





Devling



John Simmonds



Dunstan



Henderson

Promotions at Maxon America, Kansas City, MO:

Daniel M. Devling, vice president of operations at Maxon America, advances to president.

Pamela L. Swindler, senior accountant for Maxon Systems, moves up to president of Maxon Electronics and treasurer of Maxon America, Maxon Systems and Maxon Electronics.

Robert J. Thetford, one of Maxon's founders, returns to the company as president of Maxon Systems after having served as a consultant.

Changes at Tait Electronics, Houston:

Bill Canfield leaves ETrunk Systems, Yorktown Heights, NY, as sales manager to join Tait Electronics as sales manager in Houston.

Bruce Wallace exits Fujitsu Ten, Torrance, CA, as national sales manager to become sales manager for Tait, opening an office in Redondo Beach, CA.

Gary Lang departs Addington Services, Houston, as controller to become controller and secretary-treasurer for Tait.

Michael H. Barnes departs PathCom, Dallas, as chairman of the board and chief executive officer to become senior vice president of Intellicall, Dallas.

Changes at A. C. Simmonds & Sons (ACS&S), Pickering, Ontario, following the purchase of a 50.1% interest in ACS&S by Simmonds Communications (SC) in Pickering:

John G. Simmonds, president of SC, adds to his responsibilities by becoming chief executive officer of ACS&S.

Paul W. Simmonds becomes ACS&S president, and **Scott Davidson** becomes ACS&S vice president and general manager. **David C. Simmonds** resigns as ACS&S president.

L. Claude Simmonds continues as chairman of ACS&S.

Changes at Midland International, Kansas City, MO:

Simmonds Communications, Pickering, Ontario, through its SCL Inc. subsidiary, acquired Midland International on Nov. 2 from Western Auto, a unit of Sears, Roebuck and Company. **Harry Dunstan**, a director and chief operating officer of Simmonds, adds to his responsibilities by becoming president of SCL Inc.

Scott Henderson, vice president of sales for the Midland LMR division, advances to president of Midland Corporation, a newly formed business unit, with responsibility for land mobile radio and system sales in the United States, Mexico and South America.

Jim Rice, an independent consultant in Dallas, joins Midland International as general manager of operations.

Timothy Valek leaves Antenna Specialists, Cleveland, as technical services representative to join Cartwright Communications, Cincinnati, as technical services manager.



THE HIGHEST IN QUALITY

Preferred by Professionals

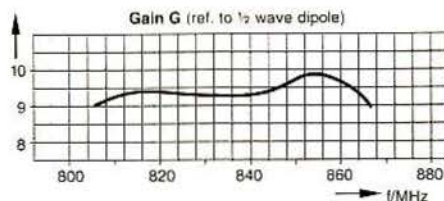
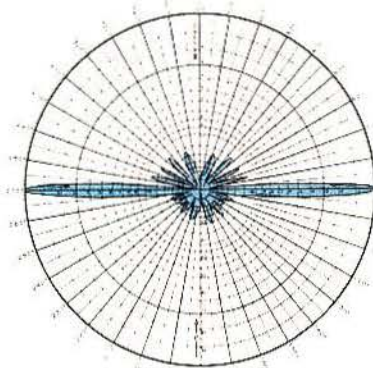
Broadband Trunking Antenna

Made to digital standards for low
intermodulation.

Features:

OGT9-806

Frequency range:	806-866 MHz
Gain:	9 dB (ref. 1/2 wave dipole)
Vertical Beamwidth:	6.5 degrees
Survival:	135 m.p.h. with no ice 95 m.p.h. 0.5 inch radial ice
Input power:	500 watts
Lightning protection:	DC ground
Options include:	Inverted model Bidirectional and Offset reflector hardware



ready for immediate delivery

SCALA ELECTRONIC CORPORATION

Post Office Box 4580
Medford, OR 97501 (USA)

Phone: (503) 779-6500
Fax: (503) 779-3991

Scala Electronic Corporation is a member of the Kathrein Group

Circle (60) on Fast Fact Card

Mobile Radio Technology

The journal of mobile communications technology

BUSINESS

Cameron Bishop, *Group Vice President*
 Mercy Contreras, *Publisher*
 Darren Sextro, *Marketing Director*
 Kathryn Buckley, *Promotions Manager*
 Denise Kettler, *Promotions Coordinator*
 Liz Turner, *Senior Production Coordinator*
 Nancy Hupp, *Advertising Production Manager*
 Dee Unger, *Advertising Business Manager*
 Tammy Kalebaugh, *Classified Advertising Coordinator*
 Tom Cook, *Group Senior Managing Editor*
 Doug Coonrod, *Corporate Art Director*
 Stephanie Hanaway, *Group Director of Special Projects*

Raymond E. Maloney, *President and CEO*
 Sandra Milan, *Corporate Circulation Director*
 Michele Bartlett, *Circulation Director*
 Larry Gorsuch, *Circulation Coordinator*
 Customer Service, 800-441-0294

ADVERTISING SALES OFFICES:

ENGLEWOOD, COLORADO
 Ruth Breashears, *Northeast region (CT, Eastern Canada, MA, MD, NH, NJ, NY, OH, PA)*
 Carla M. Gamino, *Southeast region (AL, AR, FL, GA, MO, MS, NC, OK, SC, TN, VA)*
 Diane Hite, *Midwest/Southwest region (AZ, CO, KS, LA, MT, NE, NM, NV, TX, UT, WY)*
 Mercy Contreras, *Publisher*
 333 W. Hampden Ave., Suite 803
 Englewood, CO 80110
 Phone: 303-762-1249
 Fax: 303-762-0069

SAN RAFAEL, CALIFORNIA
 Dennis Hegg, *West region (AK, CA, OR, WA, Western Canada)*
 950 N. Gate Drive, Suite 207
 San Rafael, CA 94903
 Phone: 415-491-1442
 Fax: 415-491-1842

CHICAGO
 Janet Blaney, *East Central region (IA, IL, IN, MI, MN, WI)*
 55 E. Jackson, Suite 1100
 Chicago, IL 60604
 Phone: 312-435-2340
 Fax: 312-922-1408

OXFORD, ENGLAND
 Richard Woolley
 Unit 3, Castle Farm Business Centre, Clifton Road
 Deddington, Oxford, OX15 4TP, United Kingdom
 Phone: +44 (0)869 38794
 Fax: +44 (0)869 38040

CLASSIFIEDS

Joyce Bollegar
 9800 Metcalf Ave.
 Overland Park, KS 66212-2215
 Phone: 913-967-1923
 Fax: 913-967-1901

LIST RENTAL SERVICES REPRESENTATIVE

Greg Hembree
 9800 Metcalf Ave.
 Overland Park, KS 66212-2215
 Phone: 913-967-1872
 Fax: 913-967-1897

Professional services

BROWN AND SCHWANINGER

Attorneys At Law

1835 K Street, N.W.
 Suite 650
 Washington, D.C. 20006
 202/223-8837

SERVING THE NEEDS OF THE ENTIRE INDUSTRY

Communications Technology Associates

A division of Hayes, Scay, Mattern & Mattern, Inc.

PLANNING AND DESIGN:

- 2-Way Radio
- MW & F/O
- CAD/MOT/AVL/Paging

PLUS:

- Complete A&E Services
- Bldgs, Towers, Pwr Sys
- Structural Engineering



Box 18041, 219-9555
 FAX (804) 219-9221

P.O. Box 4579
 Lynchburg, Virginia 24502

The Warner Group

MANAGEMENT CONSULTANTS

- Radio/Microwave/E9-1-1
- CAD/Mobile Data Design & Selection
- Police/Fire/EMS
- Consolidation Studies

5850 CANOGA AVENUE, SUITE 600
 WOODLAND HILLS, CALIF. 91367
 (818) 710-8855



(301) 925-9400

(800) 288-1-SFA

Fax (301) 925-8612

Telecommunication & Information Science Division

Public Safety, Transit, Government & Industry

CORPORATE OFFICE

Robert Fier, Manager
 1401 McCormick Drive
 Landover, Maryland 20785

PORTA-TECH

PORTABLE TECHNICAL SERVICE, INC.

121 Crowell Lane • Lynchburg, VA 24502



FACTORY TRAINED
 TECHNICIANS
 FOR QUALITY SERVICE

GE Portable Radio Service Depot

Factory Approved Nationwide

- Current Product Lines
- Voice Guard Certified
- Public Service Trunking
- Surface Mount Technology

(804) 239-3049



Jerry L. Simmons

Communications Systems Consulting
 Land Mobile & Microwave Systems

P.O. Box 884
 Montgomery, TX 77356

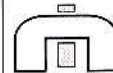
Ph (409) 588-3200
 Fax (409) 588-4434

Stuart Meyer

LAND MOBILE CONSULTANT

2417 NEWTON ST
 VIENNA VA 22180
 (703) 281-3806

FCC CALL
 8003540



Steven L. Myers, Ph.D., P.E.
 President

COMMUNICATIONS CONSULTING

MYERS ENGINEERING INTL., INC.

P.O. Box 15908
 Fort Lauderdale, FL 33318-5908
 Tel 305-345-5000
 Fax 305-345-5005

MCCON

Mobile Communications Consulting
 S. R. McConough, P.E.
 Principal

11017 Chestnut Oak Drive
 Gaithersburg, MD 20878

(301) 926-2837

THE PORTABLE DEPOT, INC.

SPECIALIZING IN GENERAL ELECTRIC PORTABLE SERVICE

- FACTORY TRAINED TECHNICIANS •
- SURFACE MOUNT TECHNOLOGY •
- FACTORY APPROVED NATIONWIDE •
- PUBLIC SERVICE TRUNKING •
- VOICE GUARD CERTIFIED •
- MPD, MPA, TPX, PCS AND ALL CURRENT PRODUCTS •



Route 2, Box 338C • Lynchburg VA 24501
 804-237-3427

HERB SACHS, CONSULTING

Specialist in Public Safety Communications

P.O. Box 729
 Bowie, MD 20715
 301-464-4268

DEPOT QUALITY PORTABLE SERVICE

Nationwide repair for the following:

- Motorola
- Regency
- Uniden
- Vertex
- Kenwood
- Maxon

Fast turnaround via UPS

\$44.00 hr. / 2 hr. max

Parts factory list / Parts return

GLOBAL RADIO COMMUNICATIONS

326A N. Highway 43, Saraland, AL 36571
 (205) 675-9191



RAYMOND C. TROTT
 CONSULTING ENGINEERS, INC.
 1425 GREENWAY DRIVE, SUITE 350
 IRVING, TEXAS 75038
 214/580-1811

RAYMOND C. TROTT, P.E.
 PRESIDENT

LAND MOBILE MICROWAVE COMMUNICATIONS SYSTEMS



OMNICOM, Inc.
 COMMUNICATIONS ENGINEERING

GENE A. BUZZI
 PRESIDENT

401 THOMASVILLE ROAD, SUITE 100
 TALLAHASSEE, FLORIDA 32301
 PHONE (904) 372-4441

FREDERICK G. GRIFFIN, P.C.
3229 WATERLICK ROAD
LYNCHBURG, VA 24502
TEL: (804)237-2044/FAX: (804)237-6063

NATIONWIDE COMMUNICATIONS CONSULTING
MOBILE RADIO, MICROWAVE, E9-1-1
CAD, PAGING, LAN
DISPATCH COMMUNICATIONS CENTERS
MULTI SITE PROPAGATION ANALYSIS

GE PORTABLE SERVICE

- FAST TURN
- WARRANTY
- \$37.00 hr./2 hr. MAX
- PARTS GE LIST
- RETURN UPS PAID

Smith Communications Service
2121 Parrish Ave., Owensboro, KY 42301
502-683-0936





Telecomm Engineering Inc.
maxon® Portable Service
CP0500, CP1000, SP2000 Series

- Factory trained technicians
- \$50.00 flat rate plus parts
- Battery conditioning included
- Warranty • Return UPS paid

3435 Mission Ave., Carmichael, CA 95608
(800) 420-5166




C lassified

Advertising rates in **Mobile Radio Technology's** Classified Section are \$69.00 per column inch, per insertion, with frequency discounts available. There is a one inch minimum.

Ads larger than one inch are sized in 1/4-inch increments and billed accordingly, as determined by total size of the ad, including ruled borders and rounded up to the nearest 1/4 inch.

Blind box ads (replies sent to **MRT** for forwarding) are \$30.00 and Fast Fact reader service numbers are available for \$25.00 per service, per insertion, to cover processing and handling costs.

Optional color, determined by **MRT** on an issue-by-issue basis, is available at \$150 per insertion.

A prepayment discount of 5% is available for all 6x or larger frequency classified advertisers who prepay their full 12 month schedule.

No agency discounts are allowed for classified advertising.

Contact Joyce Bollegar at (913) 967-1927 or fax (913) 967-1735 to place your classified ad. Or send your advertising materials and order to Tammy Kalebaugh, **Mobile Radio Technology**, Classified Advertising Department, 9800 Metcalf, Overland Park, KS 66212.

Help wanted



Better not miss this. PageNet, the largest paging company in the U.S., has recently expanded into Nashville, New Orleans, St. Louis and Minneapolis, and has aggressive plans for continued growth nationwide. **Immediate openings exist in various cities throughout the U.S. for the following:**

System Manager

In this position, you will have responsibility for the design, engineering, construction and continued growth and reliability of the complete paging system. Knowledge of paging systems and/or RF transmitters is desired. **Dept. SM-MRT.**

System Technician

You will have responsibility for installing and maintaining base stations and paging terminal equipment. At least 1 year experience with paging or two-way transmitters is required. **Dept. ST-MRT.**

We offer competitive salaries and a full benefit package. Qualified applicants should send resume, indicating appropriate Dept. code, immediately by **FAX to (214) 985-6561** or mail to: **Paging Network, Inc., 4965 Preston Park Blvd., Suite 600, Plano, TX 75093.** Equal Opportunity Employer.

PAGENET

CELLULAR TWO-WAY PAGING PERSONNEL SERVICES

Technical & Engineering Positions Available Nationwide

Fees client paid. Send resume to address below.

ALL LEVELS OF POSITIONS FILLED NATIONWIDE

- Technicians • Engineers • Managers • Sales
- Extensive national resource of personnel

Employers: Call 606-491-5410 10 AM to 8 PM



Communication Resources

P.O. Box 141397 • Cincinnati, OH 45250
606-491-5410/FAX 606-491-4340

Two-Way Radio Technicians

Growing dealer in sunny California needs experienced Two-Way Radio Technicians. Minimum 2 years experience servicing major brands. Excellent wage and fringe benefits. EOE.

Send Resume or Contact:
Digital Communications Systems
217 N. Madison Ave.
Los Angeles, CA 90004
213/388-9598

MOTOROLA AUTHORIZED DEALER SALES & SERVICE

TECHNICIAN WANTED

Growing MSS in the economically stable West Texas area looking for **self motivated, responsible, highly qualified technician.** A minimum of 3 years experience with Motorola Two-Way radio systems. Knowledgeable with Motorola 800 MHz trunking systems both fixed and mobile.

Salary commensurate with experience, with a complete benefits package, paid vacations and holidays. Send resume with salary requirements to:

LUBBOCK COMMUNICATIONS INC.
1819 N. University Ave., LUBBOCK, TX 79415
ATTN: PERSONNEL DEPT.

Manufacturers Representatives

Growing wireless communications manufacturer providing Data Transmission, Telephone Line Extenders, Radio Switches and SCADA products to the industry seeks sales professionals to cover the following geographic areas:

States of Alaska, Washington, Oregon, Montana, Idaho, Wyoming, Utah, Colorado, New Mexico, California, Nevada, Arizona, Hawaii, Florida.

Excellent income potential with incentive arrangements: Contact Vice President Sales & Marketing, DataCom Systems, Inc. 520 N. 30th Street, P.O. Box 3485, Quincy, IL 62305

VOICE: 217-222-0160 FAX: 217-222-0912

• SALESPERSON •

Experienced, honest, to sell Motorola & Kenwood. Suburbs.

• TECHNICIAN. •

Two-way radios, field & bench. Experienced only, salary open. NYC area.

914-769-5300

SERVICE TECHNICIANS

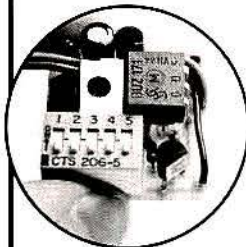
Motorola Dealer seeks highly trained service technicians, 5-10 years experience. Openings available throughout the Western U.S., immediate opening in California. Send Resume to: 42326 N. 10th St. W., Lancaster, CA 93534.

Make your classified ad stand out. Use color!

SLWPOKE

power delay timer

- Delays power-down after ignition has been turned off.
- Installs easily inside any radio.
- Programmable Time Settings
- Dealer Pricing Available



\$39.95 RETAIL

1-800-336-6825

Master Card • Visa • Discover
American Express Accepted

Hours: Monday thru Friday 8:00 A.M. to 7:00 P.M. E.S.T.
D&L Wholesale Center • 3512 Cavalier Dr. • Ft. Wayne, IN 46808

Circle (70) on Fast Fact Card

MOTOROLA Radius®

LOWEST PRICES ON PLANET EARTH
WE WILL NOT BE UNDERSOLD!

Wholesale parts & accessories too.

VHF

2 ch 25 WATT	\$300
8 ch 25 WATT	\$338
16 ch 25 WATT	\$390
2 ch 45 WATT	\$382
8 ch 45 WATT	\$390
16 ch 45 WATT	\$442

1-800-249-1250
WETEC ELECTRONICS
VISA ACCEPTED

Circle (71) on Fast Fact Card

\$50 Says You'd Rather Switch than Fight !

Are you still fighting your microprocessor-based tone panel, struggling to get the range you need and wrestling with technical problems? Then switch to a Zetron tone panel before March 31, 1994 and take advantage of this special offer:

Trade in your microprocessor-based tone panel, and we'll give you \$50 credit towards the purchase of a Zetron 38-MAX.

With a 38-MAX, you'll finally have the tone panel you need:

- ToneLock decoding down to 3 dB SINAD (no more customer drop-off!)
- Squelch-tail elimination (no more noise bursts upon releasing PTT!)
- 160 user groups simultaneously (50 CTCSS and 110 DCS!)
- Built-in RS-232 port for PC programming (in addition to DTMF programming!)
- Airtime accumulation (including the convenient "pre-pay" airtime!)
- Site alarm input (and optional remote-controlled relay output!)

No more fighting your tone panel!

12335 134th Ct. N.E. Redmond WA 98052
Phone: (206) 820-6363 Fax: (206) 820-7031

ZETRON®

(Offer subject to change without notice. U.S. customers only.)

Circle (72) on Fast Fact Card

PAGERS FOR SALE

ALL FREQUENCIES AVAILABLE

-tone ONLY

PAGERS

EN VOY

BRAVO TONE

D3 TONE

PAGERS FOR SALE

FOURTH DIMENSION INDUSTRY, INC.

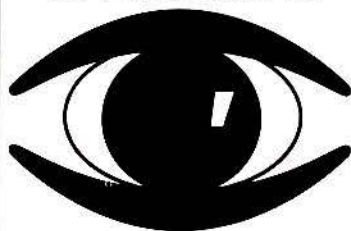
WORLD WIDE COMMUNICATIONS EQUIPMENT BROKER

3010 Deane Court, Hollisbrook, New York 11781

800-677-2220 Ext. 237

HOLIDAY GREETINGS!

!! LOOK !!



**MOTOROLA RADIUS WHERE QUALITY IS #1,
BUT WHERE WE WANT TO BE DEAD LAST —
THE LAST ONE YOU CALL FOR PRICING!**

HOLIDAY SEASON SPECIAL:

GP 300/P110 Rapid Rate Chargers...\$19.00 ea.

GP 300 Rapid Rate

1200 Mahr. Batteries\$50.00 ea.

ALL BELOW DEALER COST!

PROCOMM

Information & Fax: 805-497-2397
Orders Only: 800-497-2394

Circle (73) on Fast Fact Card

NEW! Tone-Master™ Touch Tone Decoder

SALE!



\$60 off!

MoTron Electronics

310 Garfield St., Suite 4 Eugene OR 97402

Info: (503) 687-2118 Orders: (800) 338-9058

Fax: (503) 687-2492

Decode and display Touch Tones from a tape recorder, scanner, or nearly any audio source. ✓ 16 digit LCD display, 80 digit scrollable buffer ✓ Built-in speaker ✓ 9V battery ✓ Metal case ✓ TM-16 PLUS includes RS-232 output and Software for optional date/time/ number logging using your IBM Compatible computer.

TM-16 Standard Model\$369

TM-16 PLUS RS-232 Model with Software\$239

PS-12 AC Power Adaptor\$10

S/H \$5 USA/Canada, \$15 Foreign.

Visa, MasterCard & American Express Accepted

Classified

Equipment for sale

Radius PRICE WAR!!

IF WE CAN'T SELL 'EM WE'RE
GOING TO GIVE THEM AWAY.

SP10'S, P50'S P110'S, GP300'S, M10'S, M120'S,
M208'S, & GM300'S ON HAND —
IMMEDIATE SHIPMENT. CALL US FOR OUR
"NEW" ROCK BOTTOM PRICES! 800-545-7748

TRUNKED RADIOS MOTOROLA & LTR NEW & USED

MOBILES	800MHz	900MHz
15W MAXTRAC COVERAGE PLUS W/KEYBOARD	\$1,995	
COVERAGE PLUS MAC COMPUTER W/SOFTWARE	\$2,995	
15W TRAXAR	\$195	
15W MOSTAR	\$295	
15W/12W MAXTRAC	\$495	\$595
35W/30W MAXTRAC	\$595	\$650
12W B5 SPECTRA 10 SYS SCAN		\$795
30W B5 SPECTRA 10 SYS SCAN		\$995
35W SYNTOR X VBJ'S W/MULTI SUB		

FLEET	\$295
35W SYNTOR X SMARTNET	\$995
35W SYNTOR 9000E SMARTNET 1	\$1,495
25W PP1000	\$795
PP1000X B5/B6 USED	\$995
25W GX 3030T 7 SYS SCAN NEW	\$795
CONTROL STATION PKG (PWR SUP, MIC, TRAY)	\$150

PORTABLES	
2W MTX800 W/CHARGER	\$595
2W MTX810 6 SUS/3 SUBS/CONV	
CHRG	\$695
3W MTX800	\$895
2W MTX900 2 SYS/3 SUBS/CONV CHRG	\$695
3W STX 3 BUTTON DISPLAY	\$895
3W STX DTMF SYS/15 SUB	\$1,095
3W STX SMARTNET 1	\$1,295
3W STX SMARTNET 11, 111 GEMINI	\$1,495
2W HX580T NEW SMALLEST UNIT IN USA	\$895

MOTOROLA PREVIOUSLY OWNED RADIOS

MOBILES	
100W SYNTOR 9000 VHF W/PAC-RT 7 CHARGER	\$1,995
100W SYNTOR X VHF 8F SCAN ELECTRONIC SIREN	\$1,495
100W SYNTOR X UHF 8F SCAN	
100W MARATAC UHF & VHF 8F SCAN PROGRAMMED	\$895
100W MARATAC UHF 99F OPR SEL SCAN PROGRMD	\$995
100W SYNTOR X 40-50 MHz	\$995
50W MITREK 39-50 MHz 4 FREQ	\$395
25W MAXTRAC VHF/UHF 16F SCAN	\$325
45W MAXTRAC VHF/UHF 16F SCAN	\$395

PORTABLES	
HT600/P200 VHF & UHF 6F PROGRAMMED	\$495
HT50 & P100 UHF 2F PROGRAMMED	\$345

REPEATERS - BASES	
25W RP71 UHF W/DUPLEXER NEW PROGRAMMED	\$1,795
75W MICOR UHF RCB CONTIN DUTY COMMUNITY	\$2,995
100W MSF5000 UHF CONTINUOUS DUTY COMMUNITY	\$4,500
250W MICOR UPRIGHT 42-50 MHz	\$2,500
100W MICOR 42-50 MHz	\$1,500

RADIO EXPRESS

AMERICA'S FAVORITE RADIO BUYING PLACE™
OFFICE 703-256-1928 FAX 703-830-8710

SALES LINE 800-545-7748 SALES LINE

"WE BUY USED MOTOROLA AND RADIUS" VISA-MASTERCARD-DISCOVER ACCEPTED

Circle (74) on Fast Fact Card

Why Electro Dynamics Crystal? Reliability and Dependability

LMR and Pager crystals for most
models. For the best delivery, quality
and price call: 1-800-332-9825.

1-800-EDC XTAL.

ELECTRO DYNAMICS CRYSTAL CORP.

9075 Cody

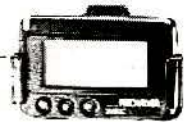
Overland Park, KS 66214

NOT JUST ANOTHER CRYSTAL CO.

• PAGERS • PAGERS • PAGERS • PAGERS • PAGERS • PAGERS • McMANUS COMMUNICATIONS

501/763-6250
FAX: 501/763-6533

"Authorized Dealer of
NEC Paging Products"



Also —

- ➔ Refurbished Motorola, NEC, and Panasonic Pagers
- ➔ New Panasonic Pagers
- ➔ Pager Parts and Accessories
- ➔ Reeds, Filters, Code Plugs, etc.

We Repair Pagers — Used Pagers Wanted

We Provide Support for our Canadian Customers, Too!
"One call gets it all!"

• PAGERS • PAGERS • PAGERS • PAGERS • PAGERS • PAGERS •

Circle (75) on Fast Fact Card

ATTENTION! USERS OF COMMUNICATION CRYSTALS Why Wait? Get It Right!

RIGHT PRICE	\$9.95
RIGHT FREQUENCY	Over 100,000 Available
RIGHT QUALITY	Lifetime Replacement Warranty
FAST DELIVERY	5-7 Working Days In Most Cases

XTAL TYPES AVAILABLE FOR:

• MAXON	• RITRON	• UNIDEN	• G.E.
• TEKK	• MOTOROLA	• KENWOOD	• REGENCY

KIRBY ENTERPRISES

4120 Kirby Avenue • Cincinnati, OH 45223 • (513) 542-3696 • 1-800-819-2904

Circle (76) on Fast Fact Card

LOOK! WHOLESALE PRICES ON ALL MOTOROLA RADIUS AND OTHER MOTOROLA PRODUCTS

RADIO CENTRAL, Inc.

1-800-923-6872

OR FAX YOUR RFQs TO (205) 476-4768

YOU'VE CALLED THE REST — NOW CALL THE BEST!
36 YEARS FACTORY EXPERIENCE

Circle (77) on Fast Fact Card

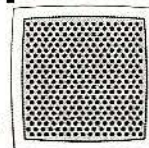
MIDLAND or 15 Watt Speakers Mics

Your choice only

\$14.79

Order Today! 1 (800) 367-2500

Mics
include
Coil
Cord
and
Connector.
Limited
supply!



unibel 2203 Elm Street
Bellingham, WA

4" cone, compatible
with most 2-way radios.

CELLULAR PHONE LABELS

PRIVATE LABEL YOUR CELLULAR PHONES

- With our in-house, full-service art department we have the ability to design top quality labels according to your specification.
- Leading communication companies across the nation depend on us for their labels, and recommend us for our services.
- Don't miss out on all the advertising you can get, just by having your and your carrier's name on the phones you sell.

Anchor Graphics, Inc.

One of the oldest and most recognized label company in the communications industry.

1467 LeMay #111 Carrollton, TX 75007 TEL: (214) 242-0439 FAX: 242-0959

Circle (78) on Fast Fact Card

Manufacture Your Own Pager

From \$ 35

If you don't, your competitors will.

(Assembly also available.)

PAGERS—All Brands—Repairs, Conversions, Parts, Accessories at low flat rates.
BEEP Plus—extraordinary new billing software



Lazer Beepers, Inc.

2-Way radio repairs at a flat rate of \$ 45.

1. 800. 354. 3405

Circle (79) on Fast Fact Card

RAMSEY COM-3

The communications service monitor that's missing one feature . . . HIGH PRICE !

- Frequency coverage 100 KHz to 999.999 MHz
- Signal Generator 0.1 uV to 10,000 uV with reverse power protection . . . no more front-end blowouts!
- Built-in 1 GHz and audio frequency counter
- Modulation includes 1 KHz, CTCSS or external
- The most popular low cost high performance monitor . . . thousands sold worldwide
- Extremely portable, only 13 pounds includes rechargeable battery at no extra cost
- Call for free 10 day trial in your shop



\$2995.00

Ramsey Electronics Inc.

793 Canning Pkwy
Victor, NY 14564

716-924-4560

716-924-4555 (FAX)

Circle (80) on Fast Fact Card

MECHEM ELECTRONICS

Mailing Address:
P.O. Box 7846
Fredericksburg, VA 22404
1003A Tyler Street
Fredericksburg, VA 22401

All equipment is sold in working condition, unless otherwise stated.

Centracom I
Radio Control Panels
T/R Cards
Dual Receive Modules
Audio Amplifiers
Spectratrac Comp. Display
Modules
Some DC Cards
LV Power Supplies
Housings/Shelves
Centracom II Console
Complete

Series 80 & 90 Remotes
Tone or DC
T1600 Remotes
Tone or DC
Option Cards
2F and 4F
4PL
4WA
Wildcard
SP's and More

SP Remotes
Tone and DC in one
Phone Patches
GE Master II Remotes
Tone or DC
Smoke Multi F
CG and Multi CG
Micor Base Accessories
TCN1107A Control Shelves
Exciter Drivers

162-174 1/4K PAS
LV 1/4K P.S.
Control Cards
LDM
TOT
S.G.
Spectratrac Encoders
Older MSY Series
Community Repeater Cards
LDM, SG
TOT, SCM
Some GE Master II Cards

Call For More Information

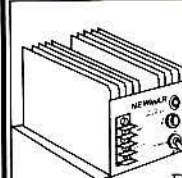
We have the R1801 DAC for your programming needs. Call us with your requests.

Phone: (703) 373-3888

We accept VISA and Mastercard

Fax: (703) 786-7968

Circle (81) on Fast Fact Card



Dependable DC Conversion

Depend on DC-DC converters with proven reliability in the harshest mobile radio applications;

Depend on **NEWMAR**

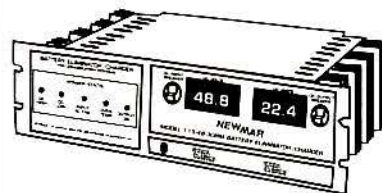
Wide input/output ranges available for:

- HEAVY EQUIPMENT
- MINING VEHICLES
- RAILROADS
- FORKLIFTS

NEWMAR

Newport Beach, CA • (800) 854-3906

Reliable Power For Microwave/Cellular Sites



48, 24, 12 Volt Outputs Available
1500 or 750 Watt Power Ratings.

NEWMAR

P.O. Box 1306 • Newport Beach, CA • 92663
Phone: (800) 854-3906 • Fax: (714) 957-1621

Circle (82) on Fast Fact Card

USED 2-WAY RADIOS

Call Sid Cohen

at AIR COMM—Phoenix, AZ

(602) 275-4505 • Fax (602) 275-4555

30%-70% savings on Motorola, GE, EFJ mobiles, base stations, portables, pagers, repeaters—primarily solid state—all frequency bands. Also, accessory items: Motorola "Systemes 90" control heads, PL and paging reeds, channel elements. Cash quotations made for purchase of above equipment.



4614 E. McDowell Rd.
Phoenix, AZ 85008



130 Danette Circle
Reno, NV 89511
(702) 852-4258
Fax: (702) 852-4258

- Chemical Ground Rods - UL Certified
- Cable Support System: SAUNDERS TELECOM GLOBETRAY
- Strut Metal Framing: GLOBE STRUT

Checking for Tone/Code on Crowded Channels!?



Order Line **1-800-327-5912**
Fax 305-771-2052

OPTOELECTRONICS

305-771-2050 • 5821 NE 14th Avenue., Ft. Lauderdale, FL 33334

5% Ship/Handling (Max \$10) U.S. & Canada 15% outside continental U.S. Visa, MasterCard, C.O.D. Cash or Money Order only
All specifications and prices are subject to change without notice or obligation

YOU NEED A DC440 TO:

Save valuable time • Provide better customer service
Keep your shop ahead of the competition
Update older service monitors

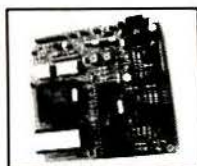
The Model DC440

- Simultaneously Decodes:
50 Sub-Audible CTCSS Tones • 106 Digital (DCS) Codes
16 Touch Tone™ (DTMF) Characters/ 126 Character Recall
- Connects to Discriminator of a Communications Receiver
- Has Serial Data Interface
- ToneLog™ Software for the PC Logs Tone/Code usage for Channel Surveys
- Directly connects to Model R10 Interceptor™ for checking: CTCSS Tones, FM Deviation, Signal Strength and Audio
- Exceptional 2x16 character back lit Liquid Crystal Display
- Optional internal 4 hour NiCad Battery Pack
- Small Size: 1.8" x 4.5" x 4" deep

DC440 - 3.1 Decoder	\$259.
CX12 RS-232C Interface Converter	\$ 89.
ToneLog™ Software for the PC	\$ 49.
NiCad 44 Battery Pack	\$ 39.

Circle (83) on Fast Fact Card

Natural Voice Playback



- Repeater Identifiers
- Site Alarms
- Remote Telemetry
- Weather Stations
- Multiple Languages
- Emergency Announcements

DataVoice - DV-64

Add a *Recorded Natural Voice* to your system or equipment. Voice vocabularies consisting of over 100 words or multiple phrases up to 1 minute in a *Natural Voice* is saved in Non-Volatile E-Prom memory. (If power is removed the recordings will not be lost). We'll record your message(s) in a male or female voice - or - you can record the library by using the optional SDS-1000 development board on an IBM or compatible computer.

Parallel input word select	8 ohm Audio output
500 ma keyline output	600 ohm Audio output
32 Kb sampling rate	+9v to +14v supply
Multiple modes	Size: 4.00" x 4.25"
Selectable timing	Connectors included

Several different models available

Palomar Telecom, Inc.

1201 Simpson Way, Escondido, Ca. 92029

(619) 746-7998 • Fax (619) 746-1610

Circle (85) on Fast Fact Card

Specializing in Motorola Radius! Large Inventory — Same Day Shipping

SP10 VHF PL 1 wt.	\$193.00
SP10 UHF PL 2 wt.	\$212.00
P110 VHF 2 ch-2 wt.	\$329.00
P110 VHF 2 ch-5 wt.	\$355.00
P110 VHF 6 ch-5 wt.	\$401.00
P110 UHF 2 ch-2 wt.	\$362.00
P110 UHF 2 ch-4 wt.	\$388.00
P110 UHF 6 ch-4 wt.	\$434.00

GP300 VHF 2 ch	\$457.00
GP300 VHF 8 ch	\$522.00
GP300 UHF 2 ch	\$489.00
GP300 UHF 8 ch	\$554.00

MEGAHERTZ TECHNOLOGY, INC.

Inquiries: 214-341-1119

Fax: 214-348-5659

Orders: 800-70-RADIO (72346)

— MasterCard Accepted —



MOTOROLA

Circle (84) on Fast Fact Card

HIGH SPEED
SIGNALLING

> DTMF >

- ANI
- MEMORY DIAL
- STORE & SEND

STEEL KEYS
SEALED GOLD CONTACTSAn ultra-high quality DTMF Encoder
for absolute reliability and function.

- Software-Driven and Keyboard Programmable
- 25 Memories • High Capacity, 30 Digits per Location
- Non-Volatile Memory • Auto Test & PTT Disable
- 5-10-20 DPS, Pure Signalling—No "Pops"
- Speed Adj. • Pause Adj. • Digit Expand • Wait/Send
- Wide Operating Range: -22 +160°F / 6-26 VDC
- Tech Level Programming • Self-Contained Slide Tone...

PK-7V, ANI3.2

PK-7H, Horiz. Model

* Call or write for ANI3.2 Info

PK-1K, ANI3.2

W/Relay

Mail
Order
To:
Pipo Communications
 ® *Emphasis is on Quality & Reliability*

 P.O. Box 2020
 Pollock Pines, California 95726
 (916) 644-5444
 FAX: 644-PIPO

Circle (86) on Fast Fact Card

CLEAN USED GEAR

 Cushman CE-4 & CE-6 Service Monitors
 GE Phoenix SX VHF, 2/16 CH & Scan
 GE MLS LB, VHF, UHF 2/8/16 CH & Scan
 GE MASTR II & Exec II LB, VHF, UHF
 GE MVP, VHF
 GE MASTR II Base/Rptr LB, VHF, UHF
 Motorola Mocom, Micor, Mitrek LB, VHF, UHF
 Motorola Moxy, Maxar, -50, -80 LB, VHF, UHF
 Motorola Mostar 800T
 Motorola Base/Rptr/Consolettes LB, VHF, UHF
 Standard GX3000 VHF, UHF 64 CH Synth/Scan
 Standard 966L LB, 75 Watt, Synth
 Mostar VHF, Maxtrac 900MHz

 NEW STANDARD RADIOS AT DISCOUNT!! CALL NOW
 Harris Alpha 2000E VHF IMTS
 Motorola Pulsar VHF IMTS & Others
 Motorola MT500 LB, VHF, UHF HT
 Motorola MT/HT/ Gang Chargers
 Standard HX300, 320, 734, 834 VHF, UHF HT
 Standard HX400 VHF, UHF 25 CH Synth 5W HT
 Uniden SPH & SPU 8 CH Synth HT
 Wescom 2 GHz Microwave, MUX
 Standard GX-1500U
 GE Deskon II DC Remotes, Motorola Local Remotes
 MORE - MORE - MORE - MORE - MORE - MORE

VersaTel

We Buy Used Equipment — CALL!

Ph: 1-800-456-5548

Fax: 1-307-266-3010

Circle (87) on Fast Fact Card

USED RADIO EQUIPMENT

- GE Voter Panels, VSDE 6 slot \$150.
- PD 1109 SMR Base Ant.- New \$250.
- MOT. MSR 2000 VHF 100w Base \$1600.
- Micor-VHF/UHF 40 to 100w CALL
- MCX 100-UHF 32 ch. 15w Synth \$250.
- Electrocom MDT 850 Term \$100.

Call or Fax 713-522-6309 for Full List

The Radio Shop Houston Texas **713-526-8000**

Circle (88) on Fast Fact Card


 Link Communications
 P.O. Box 1071
 1404 Gold Ave. Suite #1
 Bozeman, MT 59715
 (406) 587-4085 Voice
 (406) 585-7575 Fax

ANALOG TELEMETRY FOR YOUR SITE

- 8 Channels of Analog Telemetry
- Voice Synthesizer Readback of Analog Values
- DTMF and RS-232 Serial port Access
- High and Low Alarm Points per Channel
- High and Low tracking of each Analog Channel
- Access can be from 1-6 DTMF digits
- 10 Analog Conversion Faceplates
- All Analog inputs can be Field Calibrated
- 4" x 6" 4-Layer Board, 20 Pin Solderless Connector
- 60mA @ 12 Volt operation

Only \$299.95

MasterCard, Visa, Discover, COD's

Circle (89) on Fast Fact Card

 WE BUY
 AND SELL
 USED
MOTOROLA
 AND **GE**
FM
TWO-WAY
RADIOS
SCHAEFER
RADIO CO.

 1301 Grant St.
 Box 395
 Denver,
 IA 50622
 PHONE:
 (319) 984-6115
 FAX:
 (319) 984-6220

- 3 800MHz Trunked Controllers, T1958-SP800
- 9 MX340, 800MHz Conventional, H35AAJ6110
- 25 SyntexK, 800MHz Trnk. & Conv. T45VBJ5G11
- 8 SyntexK, 800MHz Trnk. & Conv. T45XAJ5G11
- 5 GE Corona, 800MHz Trunked, 30 watts
- 13 GE Marc V Portables, 800MHz Trunked
- 26 Micor, 495MHz, T74RTA3000
- 44 Syntex, 495MHz, T64SRA3200
- 2 MT500, 495MHz, H34BBU3144
- 4 Micor Bases, 462MHz, B54RCB1105ATSP2
- 12 Motrac Rptrs, 460MHz, C24MSV3101T
- 50 Syntex, 460MHz, T64SRA3200
- 12 Micor, 460MHz, T74RTA3000
- 11 Mitrek, 460MHz, T44JJ43000
- 5 Maxar 80, 460MHz, D34TS43000
- 140 MX340, 460MHz, H44AAU3140
- 38 MT500, 460MHz, H34BBU3124
- 1 Micor Rptr, 406MHz, C64RKB3106AT (w/DPV)
- 16 Syntex, 173MHz, T83XTA1200 (w/DPV)
- 8 Micor Bases, 153MHz, C73RFB1106
- 27 Syntex, 153MHz, T63SRA3200
- 38 Mitrek, 153MHz, T63JJA3900
- 93 Micor, 153MHz, T73RTN3100
- 4 Moxy, 153MHz, D43GMA8000
- 4 MT500, 155MHz, H33BBB3184
- 54 Miniter I Papers w/Charger Amplifiers, 154MHz
- 2 Micor Bases, 72MHz, C42RCB3105
- 1 Micor Base, 43MHz, B9JCB31105

- 9 Micor Bases, 47MHz, C14RTB3426
- 31 Mitrek, 47MHz, T81JJA4900
- 8 Mitrek, 48MHz, T51JJA4900
- 7 Mocom 70, 46MHz, T71BBB1000
- 14 Maxar 80, 47MHz, D51TSA4000
- 5 GE MASTR II, 48MHz, MC74CC531
- 8 Moxy, 31MHz, D31GMA4000
- 20 DC Remote Desk Sets, T1376
- 3 Local Desk Sets, T1370
- 100 Syntex X 9000 Control Heads
- H3CN1033A
- 20 Johnson LTR 6700 Mobiles

R&R
USED RADIOS

Low Band

- 2 Motorola Mocom 70 3036, each. \$50.00
- 2 Motorola Mitrek 3036 Call
- 7 Motorola Micor 47MHz Call
- 1 Motorola Micor Base 47MHz Call
- 1 Regency MC61 Mobile 47MHz \$50.00

High Band

- 6 Motorola Maxar Car. Sq. \$50.00
- 25 Radius P100 w/Accy. \$295.00
- 3 Regency MC41 \$50.00
- 10 Maxon CS/CP \$25-\$50.00

UHF

- 50 GE MRI, 2uAH, CSg., New Battery, Charger \$75.00
- 10 Aerotron Concept (synth.) Cheap
- 100 Motorola Mocom 70 Cheap
- 5 Motorola Mitrek Cheap

216-759-7170

8 am - 5 pm EST

PAGERS FOR SALE

ALL FREQUENCIES AVAILABLE

ALPHA NUMERIC
DISPLAY PAGERS

BRAVO ALPHA

PMR 2000

IDP 7000

FOURTH DIMENSION INDUSTRY, INC.

WORLDWIDE COMMUNICATIONS EQUIPMENT BROKER

300 Deane Court, Hollisbrook, New York 11761

(516) 752-1221 Ext. 297

PAGERS FOR SALE

Equipment for sale

Now, here's a switch!

CHARGE GUARD

automatic ON/OFF timer switch
for two-way radios, cellular phones

EASY TO INSTALL.

NO IGNITION SWITCH CONNECTION!

PROGRAMMABLE.

15 MINUTES TO 15 HOURS!!

Prevents Dead Batteries.

MADE IN U.S.A.

PROTECTS YOUR RADIO.

SUGGESTED LIST PRICE ONLY \$74.95

MODEL CO-18 12V.
12 AND 24 VOLT MODELS AVAILABLE

CALL NOW FOR MORE INFORMATION!

ASK ABOUT
OUR NEW
DEALER KIT*



CHARGE GUARD

400 Highland Avenue
Altoona, PA 16602

800-458-3410

*1991 ChargeGuard

Circle (92) on Fast Fact Card

STICKERS, LABELS, NAMEPLATES

ADVANCE LABEL & TAG

1725 N. McDONALD ST.

McKINNEY, TEXAS 75069

1-800-466-5345 214-542-5345

We design and manufacture LABELS that

STICK and guarantee the QUALITY.

CALL FOR FREE SAMPLES

Outstanding quality at competitive prices.

Se Habla Español



ELECTRONICS CENTER

3913 BROADDUS AVE. EL PASO, TX. 79904

BUYING LATE MODEL UN-
WANTED 2 WAY RADIO EQUIP-
MENT, COMPUTERS, PRINTERS
& TELEPHONE SYSTEMS.

SEND OR FAX YOUR LIST
TODAY. PLEASE INCLUDE QTY,
MODEL NUMBERS & DESCRIP-
TION. WE ALWAYS GIVE

PROMPT REPLIES EVEN IF WE
ARE NOT INTERESTED. IF YOU
SELL BY BID OR AUCTION ADD

OUR COMPANY TO YOUR BID
LIST. WE ARE OPEN MON-FRI
7:AM TO 5:PM & SAT 8:AM TO
1:PM. MST OUR FAX IS ON 24

HRS. 7 DAYS WE ALSO SELL
EQUIPMENT. FOR LIST SEND
OR FAX YOUR ADDRESS,
TELEPHONE AND FAX NO.

FAX 915-562-3827 VOICE 562-1000

COMPATIBLE MOTOROLA® RADIO PROGRAMMING EQUIPMENT

NEW PA3 \$169.00
New-Visar® Prog. Cable...CALL!

PA-1* CALL!

- Supports full spectrum of programmable Motorola Radios®
- IBM AT/XT compatible

PA-2* added features \$129.95

- Rechargeable Ni-CAD battery
- Data and Active indicator lights

Precision Designed Metal Cases

PROGRAMMING CABLES

Our Programming Cables are precision devices designed specifically for each radio. Put your confidence in our quality.

NEW! HT1000/MT2000/JEDI...CALL

SPECIAL: GP300/P110...\$119 HT50/P100...\$85
HT600/MT1000/P200...CALL

Full Line Programming Cables:
SABER, SPECTRA®, STX®,
RADIUS®, MOBILES, MAXTRAC®

Note: Hardware Only. Software sold by Motorola, Inc.

POLARIS INDUSTRIES

a Division of Southern Computer Corp.

141 W. Wieuca Rd., Suite 300B
Atlanta, GA 30342-3219



WE OFFER:

- ✓ Precise metal frames
- ✓ Quality P.C.B. designed
- ✓ GOLD connector pins
- ✓ Battery Eliminator option
- ✓ Coil cords
- ✓ 1 Year Warranty

DON'T SETTLE FOR:

- ✗ Inferior designs
- ✗ Velcro straps
- ✗ Cheap construction
- ✗ Plastic rigged boxes

Dealers
Welcome!

Call Today!

800 - 752 - 3571

24 HOUR FAX LINE 404-252-8929

ORDER BEFORE 1PM AND WE WILL SHIP SAME DAY

Motorola® and other products are trademarks of Motorola, Inc.

Circle (90) on Fast Fact Card

Introducing...



Model 1012C

The next generation of
status reporting equipment from:

Pyramid
Communications

210 Main St. #153 Seal Beach CA 90740 Order Hotline: (414) 730-4190

Finally, a low cost reliable alternative to
Speedcall's™ 912C status reporter...

- * Direct replacement for aging units or add ons.
- * Status reporting, sel call, horn honk, interrogate, group call, console assign and ANI on PTT.
- * Parameters are front panel programmable. Extensive self test and alignment capabilities.
- * LTR™ and Motorola trunking compatible.
- * Compact: Only 5 1/4" x 4 1/4" x 1 1/4"

Suggested Retail: \$425⁰⁰

Circle (91) on Fast Fact Card

Radius

PRICES SLASHED!

M10 MOBILES

Lowest USA Price On

V.H.F. CH.	POWER	MODEL NUMBER	LIST	1/8	3/4	1 1/2	3 1/4
146.174	10	MA3000-2002	297	277	280	283	310

M120 MOBILES

Lowest USA Price On

V.H.F. CH.	POWER	MODEL NUMBER	LIST	1/8	3/4	1 1/2	3 1/4
146.174	10	MA3000-2002	437	417	420	423	450

GM300 MOBILES

Lowest USA Price On

V.H.F. CH.	POWER	MODEL NUMBER	LIST	1/8	3/4	1 1/2	3 1/4
146.174	10	MA3000-2002	522	502	505	508	535

GP300 PORTABLES

Lowest USA Price On

V.H.F. CH.	POWER	MODEL NUMBER	LIST	1/8	3/4	1 1/2	3 1/4
146.174	10	MA3000-2002	607	587	590	593	620

P110 PORTABLES

Lowest USA Price On

V.H.F. CH.	POWER	MODEL NUMBER	LIST	1/8	3/4	1 1/2	3 1/4
146.174	10	MA3000-2002	692	672	675	678	705

P50 PORTABLES

Lowest USA Price On

V.H.F. CH.	POWER	MODEL NUMBER	LIST	1/8	3/4	1 1/2	3 1/4
146.174	10	MA3000-2002	777	757	760	763	790

SP10 PORTABLES

Lowest USA Price On

V.H.F. CH.	POWER	MODEL NUMBER	LIST	1/8	3/4	1 1/2	3 1/4
146.174	10	MA3000-2002	862	842	845	848	875

800-231-0103 Orders ONLY!

Questions: 303-249-1414

FAX - 24 hr: 303-249-4334

Our 21st Year!



ETRUNK SYSTEMS, INC.

The Industry Standard For All Band Trunking

- One board fits most mobiles and portables
- ETrunk® equipped radios available
- Low cost, easy to install
- No special site controllers needed
- Dispatch and interconnect capable
- All board features are software controlled
- Compatible with more radios than all our competitors combined!

1-800-4-ETrunk (914)245-1128 Fax retrieval system: 1-800-292-9723 (914)245-2382

Circle (93) on Fast Fact Card

MIDLAND LMR

LAND MOBILE RADIO Nationwide

Factory Approved
WHOLESALE PRICES

- Large Inventory • Fast Service • Flat Rate Repair Service
- Complete Dealer Support Program

All Dealer Inquiries
Welcome

SAME DAY SHIPPING

Call for Weekly Specials!
Refurbished Equipment Available
Wholesale Prices to Dealers Only.

(800) 726-9015
(612) 884-8352

FAX (612) 884-8356



DISTRIBUTING

9635 Girard Ave. South
Bloomington, MN 55431

Circle (94) on Fast Fact Card

Sharp
COMMUNICATION



PAIGE TIM SHEILA

Order Today! Ship Today!

MIDLAND LMR
LAND MOBILE RADIO

TOLL-FREE 1-800-548-2484

WHOLESALE

COMMUNICATION EQUIPMENT

Mobile Radios • Telewave Site Management
Equipment • RFI Connectors • Whelen Strobes

Call for Our
FREE FLYER!

- VISA
- MASTERCARD
- DISCOVER
- AMEX

Circle (95) on Fast Fact Card

COMPUTERIZED DISPATCH

TURN YOUR PC INTO A DISPATCH CONSOLE
BIG FEATURES WITH A SMALL INVESTMENT

STANDARD FEATURES INCLUDE:

- ▲ Displays & Logs All System Activity
- ▲ Transmit By Keyboard, Mouse, or Touch Screen
- ▲ Selective Calling By Individual or Group ANI
- ▲ Transmit By ANI, Unit #, or Name
- ▲ Individual & Group Enable/Disable

CALL IDA CORPORATION 800-627-4432

Circle (96) on Fast Fact Card

PAGERS FOR SALE

ALL FREQUENCIES AVAILABLE

NUMERIC
DISPLAY PAGERS

RPR 2000 DISPLAY

DIMENSION 2000 DISPLAY

DAN A & C STYLE

PAGERS FOR SALE

FOURTH DIMENSION INDUSTRY, INC.
WORLD WIDE COMMUNICATIONS EQUIPMENT BROKER
3285 Dante Court, Hollisbrook, New York 11941 (516) 247-1220 Fax 247-1221

BUY-SELL-TRADE

GE 900MHz Paging TX	Call
GE 900MHz SMR Repeaters	Call
Micor Base Repeater	from \$1295
Master II Base Repr	from \$1295
Mocom 70 Consoles	from \$250
Mocom 70 Mobiles	from \$100
Micor Mobiles	from \$150
Mitrek Mobiles	from \$150
Master II Mobiles	from \$150
EX II Mobiles	from \$100
Phoenix / MVP	from \$150
DC/Tone Remotes	from \$100



Bob Barnett
Owner—W5RHL
FCC 1st Class Tech
30 Years in
Communications

Bases / Repeaters / Mobiles
No Used Pagers-Portables or Parts
Cash + Shipping Paid Promptly
Call for Quote or Sales List
Warehouse 1-501-835-7066
Fax 1-501-835-8766

BARNETT ELECTRONICS, INC.
8718 Wilhite Lane • North Little Rock, AR 72120

COMPLETE CHANNEL
ELEMENTS ON YOUR
FREQUENCY FOR
\$25 - \$35!!!

ORDERS ONLY:

1-800-237-6519

INQUIRIES AND IN LA:

504-361-5525

FAX 504-361-5526

- ☐ Motrac; Micor, Mocom; Mitrek; Etc.
 - ☐ MT's, and GE Elements. Call for prices.
 - ☐ Any desired Frequency available for fast delivery.
 - ☐ Lifetime Warranty on Crystals
 - ☐ Trade-in credit on your Old Channel Elements
 - ☐ We Buy Used Elements
- Try us first. We always have your frequency available.

NKX

1814 Hancock St.
Gretna, LA 70053

Equipment for sale

PAGERS FOR SALE

ALL FREQUENCIES AVAILABLE

— TONE / VOICE PAGERS —

BPR 2000

SPIRIT

KEYNOTE

PAGERS FOR SALE

FOURTH DIMENSION INDUSTRY, INC.

WORLD WIDE COMMUNICATIONS EQUIPMENT BROKER

3080 Deane Court, Holbrook, New York 12344 (518) 733-1223 Fax: 733-1227

BUY - SELL

RADIOS

NEW & USED

Johnson - Motorola

Standard - Uniden

Buy-Comm-Co.

Steven Kenney

1-800-347-4121

(602) 585-3900

FAX (602) 585-6900

29669 North 45th Street

Cave Creek, Arizona 85331

BUY & SELL

Used GE-MARC

Trunking Radios.

TMX 8310 TMX 8210

TMX 8510 TMX 8712

TMX 8825 TMX 8615

Call John Peacock

Tel. 800-232-7715

Fax 501-735-7799

Radius

Lowest prices PERIOD!

800-231-0103

TOWER LITE OUT?

Don't worry...
The Bramco
Tower Lite
Monitor
Will Phone You
and
Tell You About It!

Signaling and
Control Is
Our Business.

**REEDS and
FILTERS for
PAGERS**

Bramco, Inc. 513-773-6255
Piqua, OH Fax: 773-8003

Circle (98) on Fast Fact Card

Hy-Q
International (USA)

☐ **PAGER CRYSTALS**

☐ **COMMUNICATION CRYSTALS**

☐ **CHANNEL ELEMENTS**

☒ **Recrystallized**

☒ **Complete Elements**

**48-HOUR
SERVICE
AVAILABLE**

(606) 283-5000
FAX: 1-606-283-0883
1438 Cox Ave., Erlanger, KY 41018
(Greater Cincinnati Area)

"Precision Quality Quartz Crystals—
Made to Your Specifications"

Circle (97) on Fast Fact Card

distributed by

CA Communications Associates Inc.

(800) 435-9313 In Illinois (800) 892-1611
Order Fax (800) 284-4934

• Base Station Antennas

• Cavity Filters

• Multicouplers

• Duplexers

DECIBEL

• Power Amplifiers

• Combiners

• Filters

Call Today!

Circle (99) on Fast Fact Card

GE RADIOS
AT WHOLESALE PRICES

• We will meet or beat any published price.

• The largest GE dealer in N. America.

• Rush Delivery in the U.S., Canada & Mexico

• We buy used & take trade-ins on GE 2-Ways

• FREE sales and service support.

1-800-336-6825

Hrs.: Mon. thru Fri. 8 A.M. to 7 P.M. E.S.T.

Two-Way Wholesale Distribution • 3512 Cavalier Dr. • Ft. Wayne, IN 46808

Circle (100) on Fast Fact Card

Equipment for sale

**Remote Controls.
Pure and Simple.**



Automation &
Electronics
Engineering, Inc.

13667 Floyd Circle • Dallas, Texas 75243
1-800-527-4596

Circle (101) on Fast Fact Card

Call

Joyce

Bollegar

at

913-967-1923

to place your

classified ad

in the

very next

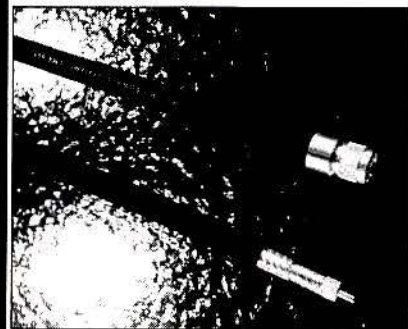
available

issue.

**YOUR STOCKROOM
HAS IT ...**

T TIMES
MICROWAVE SYSTEMS

LMR™
Flexible Communications
Cable



**THE
COMMUNICATIONS
EXPRESS**

**US 1-800-631-7297
FAX 1-800-327-0007**

Circle (102) on Fast Fact Card

PAGER CRYSTALS

800+ FREQS AVAILABLE FROM STOCK

ONE SOURCE - ONE CALL - INSTANT SATISFACTION

CRYSTRONICS

PH: (305) 566-6949 FX: (305) 566-5971

POPULAR PAGER

WHEN QUALITY COUNTS, CALL



CRYSTALS-ELEMENTS

**44 YEARS IN THE INDUSTRY
EXPEDITE SERVICE**

MENTION THIS AD
AND RECEIVE OUR QUICK REFERENCE TO
COMMUNICATIONS AND PAGER CRYSTALS, FREE.

PHONE 1-800-725-1426 | 24-HOUR FAX 1-800-322-9426
INTERNATIONAL CRYSTAL MANUFACTURING CO., INC.
P.O. BOX 26330 • OKLAHOMA CITY, OK 73126

**Identify and prevent RF
communications site
interference in minutes
rather than hours.**

Powerful PC software that picks up where
all other intermodulation programs leaves off.

- Transmitter Noise/Receiver Desense Analysis
- Intermodulation Signal Level Analysis
- Eliminates Manual look-up of filter curves

COMSITE™ PLUS

For a brochure, call 1-800-845-0408

Circle (114) on Fast Fact Card

Channel Elements

**100,000 Freqs in Stock!
MASTR II, MVP, EXEC II
MICOR, MOCOM & MOTRAC**

\$20 w/trade or \$25 w/o trade

Lifetime Warranty

3-Day Standard Delivery

1-800-237-9654

FAX: 513-542-8870

CHANNEL ELEMENT HQ.

4120 Kirby Road

Cincinnati, OH 45223

We Buy Channel Elements.

**USE
MOBILE
RADIO
TECHNOLOGY
CLASSIFIED
ADS**

Classified

Equipment for sale

CAL CRYSTAL LAB., INC.

CRYSTALS FOR ALL RADIOS

- Communication Crystals
- All makes and models
- Channel Elements
- Recrystalized and compensated

Competitive pricing!

Emergency Service

For Crystals 24 Hours • 72 Hours • 1 Week
Normal Delivery 3 Weeks

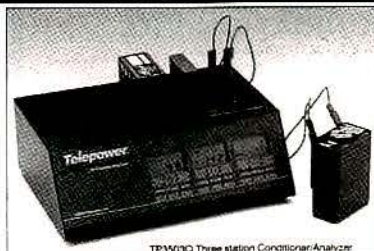
800-333-9825

FAX 714-491-9825

1142 N. Gilbert Anaheim, CA 92801



Antenna Farm
Communications Supply



TP3503Q Three station Conditioner/Analyzer

TELEPOWER CONDITIONER/ANALYZER

RELIABLE, AFFORDABLE BATTERY MAINTENANCE

The Telepower Conditioner/Analyzer features three different models which charge and maintain one, three or as many as six batteries simultaneously.

Provides the critical information needed to ensure optimum battery performance.



1-800-255-6222



"Find Out What Everyone Is Talking About!"

ANTENEX

2000-200 Bloomingdale Road, Glendale, IL U.S.A.

SYSTEM
PROPAGATION
SYSTEMS, INC.

Call or write for complete catalog on
ANTENEX mobile, portable, and
base antennas, mounts, cable,
connectors, and accessories!

Order: 800-323-3757

Fax: 800-851-9009

Summer
1992

ANTENEX

?

WHOLESALE CATALOG AND PRICE LIST

COOK'S COMMUNICATIONS

GE

LTR

160 N. Broadway
Fresno, CA 93701



VISA
MASTERCARD

MOBILE AND PORTABLE RADIOS AT
WHOLESALE PRICES

1-800-233-8818

IT MAY BE WINTER IN MONTANA
BUT OUR PRICES ARE SIZZLING!!!

WOLFE COMMUNICATIONS

1113 Central Ave. • Billings, MT 59102
406-252-9220 • FAX: 406-252-8617

Call or write for our current flyer
BUY — SELL — TRADE

LAND MOBILE RADIO BBS

Buy - Sell - Trade used radio equipment
with hundreds of other dealers nation-
wide. Call with your modem to register
now.

The CommLine BBS

313-854-6441

USED PAGERS

Motorola and NEC. Reconditioned on
your channel w/warranty, or "as is"

ACS

(303) 337-4811

FAX (303) 337-3084

**QUALITY
USED PAGERS
LOW BAND
VHF/UHF & 900Mhz**

MOTOROLA
PANA DATA 4000
BRAVO IDP 5000 IDP 7000
AEC AEC AEC
ENVY
SPIRIT
BRAVO TONE
FOURTH DIMENSION INDUSTRIES, INC.
225 DARTY COURT
BROOKLYN, NEW YORK 11201 FAX 212-647-4640

For Sale Centra Com I —Whole or in Parts—

NEW

Centra Comm II
Engraved Buttons.
\$6.50 per button.
All orders shipped
within 48 hours.

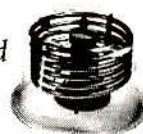
Centra Com II
Reprogramming and
Custom Changes

Northeastern Communications Inc.
Waterbury, CT 06708

(203) 575-9008

UAntenna

Low Profile • Low Band
Antenna for Radio
Communication



FEATURES:

- Up to 95% Height reduction
- Easy Installation
- High Performance • Low Cost

Model CR109A
**THE ULTIMATE
LOW BAND**

COM-RAD INDUSTRIES
PO Box 88, Wilson, NY 14172

For Immediate Fax Info & Technical Assistance,
Tel: 716/751-9945 • Fax: 716/751-9879

SHORES COMMUNICATION CO., INC.

602-425-5870



- SALES
- SERVICE

ICOM

ICOM Factory Authorized Sales & Service
Radios & accessories bought, sold and repaired.
Warranty Service Center. Dealers Welcome. Land
Mobile & receivers only (no marine or amateur).

SWS SECURITY

1-800-776-8274

Equipment for sale

MOBILES • BASES • PORTABLES • PAGERS • REMOTES

PCI — PEKAAR COMMUNICATION INC.
Steve's back, formerly of Gregory Electronics Corp.
\$ Specials of the month. \$

GE S990 Control Head 126 channel	NEW \$75
GE MPD PLS Letter Carrying Case, NEW, Large or Short Style with Strap Only	\$15
GE S550 16 Plus trunking control heads	NEW \$50
Motorola Mitrek Model T51JJA 2900 60 watt 42-50 range 4 freq. with accessories, clean, no PL	\$150
Motorola MOCOM 70 U41BBA 1900 60 watt 42-50 range 4 freq. w/access, clean, no PL	\$95
Motorola Micor U71RTN1100 42-50 100 watt w/acc, no PL	\$165
Motorola Micor U51RTN1100 42-50 60 watt w/acc, no PL	\$135
GE MPE Portable Model P665RBWBMX 450 to 470 range, 2 freq. w/CG	\$85
GE PE Portables Model P665RBW 450 to 470 range, 2 freq. w/CG	\$75
Celec Vega mobile decoder Model 324	\$8
Regency BTH201 HB w/accessories	\$45
Regency Model TR201 HB w/accessories	\$75
GE PE Portables-Most ranges T.S. AS IS, WITH ICOMS	\$25
Ericsson portable hands free speaker mics, type 4502 CMO-TJM1B	NEW \$10
Motorola MT500 Portable Rapid Rack Charger	\$75

Catalog Available If you can't find it, try us! Call (201) 772-0704

BOARDS • STRIPS • ACCESSORIES • ELEMENTS • REEDS

Circle (103) on Fast Fact Card

USED 800 MHz RADIOS
CONV. E.F.J. NEARLY NEW
WITH REPEATER.
MAKE OFFER.
914-769-5300.

**USED RADIOS
at Low Prices!**

- MICOR
- MITREK
- PORTABLES
- MOCOM 70
- MAXAR
- RPTRS
- GE
- RCA
- ACCESSORIES
- TONE ELEMENTS
- CRYSTAL ELEM
- BASE STATIONS

Large Quantities • (817) 433-5452

Buy Direct  **At Wholesale Prices**
GENERAL COMMUNICATIONS
DISTRIBUTORS OF MOBILE COMMUNICATIONS EQUIPMENT

Largest Inventory • Quality Service • Fastest Delivery & Best Prices
5157 Anton Drive • Madison, WI 53719 • 608 271-4848 • FAX 608 274-2080

800 356-3200
Because your business takes you everywhere.

Buy Direct  **At Wholesale Prices**
GENERAL COMMUNICATIONS
DISTRIBUTORS OF MOBILE COMMUNICATIONS EQUIPMENT

Largest Inventory • Quality Service • Fastest Delivery & Best Prices
5157 Anton Drive • Madison, WI 53719 • 608 271-4848 • FAX 608 274-2080

800 356-3200
Because your business takes you everywhere.

**BUYING ERICSSON - GE EQUIPMENT
CALL OR FAX FOR QUOTE**

MOTOROLA !!!!!!! ALL UHF

MSF5000 RPTR. MAXTRAC 300 STATION
MCR100 RPTR MICOR RPTR HT600 P200
GP300 HT90 AND MORE. CALL FOR LIST.

ERICSSON-GE

Rangr 150-174 40W less acc.\$325
MPI UHF 4W W/CG & Charger\$165
MPI Multi-Charger, used checked\$40
Delta-SX 450-470 less acc. 100W\$325
Delta-S 450-470 40W S-990 acc.\$299
Delta-S 450-470 40W no acc.\$199
Delta-S 450-470 40W less CG/acc.\$135
Delta-S Low band and "T" bandCall
UHF MPD and MPA 450-470Call
PLS/MPD/MPA Multi-chgr, NEW\$100
MASTR II 150-174 110Wfrom \$115
MASTR II 450-470 40W w/acc\$165
440 MHZ MASTR II/CMVP RX F.E.\$40
S-990 128 ch. head w/warranty\$125
MPS/MPR/MPX/MPI/MPD Chargerscall

NEW LONDON TECHNOLOGY

231 Old Timberlake Road
Forest, Virginia 24551
TEL 804-525-0068 FAX 804-525-0078

LIGHTNING PROTECTION

by Rabun Labs, Inc.

The ILD/P™ automatically detects lightning when it is 2-5 miles away, gives an alarm, switches power sources, or automatically disconnects power, telephone and coax lines until the storm is a safe distance away then automatically reconnects. 12 models available.

- Computers • Satellites • Antennas
- Pumps and Controllers
- Radio Communications

**DEALER INQUIRIES INVITED
1-800-788-1824**

**MOTOROLA RADIUS
RADIO WHOLESALE**

*One of the largest stocks of
Motorola Radius in the world!*

CALL 1-800-53-RADIO (72346)

Promotional



The perfect promotional, executive or sales incentive award for the communications industry.

Display your company name or logo on a brass plate, accented on a solid walnut or oak base.

Various styles and sizes available.

For more information call or send request for brochure.

CREATIVE SCULPTURES, INC.
HRC 33 Box 3023 • Las Vegas, NV 89124
(702) 875-4056 Tel/Fax

**Towers and Land for Sale
LIQUIDATION**

Former Western Union Sites, CO, IL, IN, KS, KY, MO, NE, OH, OK, PA, TN, TX, VA, W/V, WY. Land, buildings and towers.

Agent Joyce Castille.
800-852-8166

Mobile Extender DGME 1000
Digital Gated Repeater Maker DGRM 501
Use with most any two transceivers. Repeater, Extend, Cross, Band & Link, Lease Line Eliminator. Digital gate circuit for positive control & min. power draw.

DGRM 501 \$89.00	DGRM 501B & DGME 1000 \$169.00
---------------------	-----------------------------------

COMM-NET 2000
1-800-283-5158

Made in the USA
1 YEAR LIMITED WARRANTY

Equipment wanted

BUY & SELL

ALL MANUFACTURERS
ALL BANDS

Call Brian Johnston

404-434-5949

BUYING USED RADIOS



Johnsons-Kenwoods
800/900 MHz

Fleet Call of Texas, Inc.
(214) 330-5161 Ric

WANTED DEAD OR ALIVE!

MOTOROLA BRAVO DISPLAY PAGERS
LOW BAND, VHF, UHF, 900MHz

Top Dollar Paid!

301-470-4253

Services

FCC License Preparation

Fast, Easy, Home Study, Inexpensive.
Land Mobile Handbook, New Employment Guide.
Audio & Video Courses Available.

General Radio Telephone License.
WPT PUBLICATIONS

1-800-800-7588 FREE Details

STUDY LAND MOBILE COMMUNICATIONS AT HOME!

38 lessons written exclusively for Mobile Com-
munications Servicing. \$375.00. Call or write for
free information:



P.O. Box 8278
Lumberton, TX 77711-0278
(409) 755-7838



DUPLETUNE
303 FRIES RD
TONAWANDA, NY 14150
716-834-2787

REPAIR & RETUNING
OF
DUPLEXERS
Filter Systems
Rx Multicouplers



WE BUY USED GE 2-WAY RADIOS

We'll offer you cash or discounts for your
used GE trade-ins. Fax a list or call John:

1-800-336-6825

Fax: 219-471-5294

Hrs: Mon. thru Fri. 8 A.M. to 7 P.M. E.S.T.



Two-Way Wholesale Distribution • 3512 Cavalier Dr. • Ft. Wayne, IN 46808

Circle (104) on Fast Fact Card

LTR Trunking Systems HAUG COMMUNICATIONS, INC.

East Hwy. 36
Seneca, KS 66538

913-336-3579 • 800-325-8646

Equipment Wanted

Motorola, Johnson, GE,
EFJ, Uniden, Standard

Buy-Comm-Co.

1-800-347-4121

FAX (602) 585-6900

Computer software

TCS

CONSULTING SERVICES

- Feasibility Studies
- Path Analysis
- Specifications
- License Assistance

ENGINEERING AID SOFTWARE

- Microwave Calculations
- Multi-Point (SCADA)
- Topo Graph (Profiles)
- HAAT Calculations

30 Second & 3 Arc Second Data Bases Now Available

TECHNICAL COMMUNICATIONS SOFTWARE

P. O. Box 884 Montgomery, TX 77356 • (409) 588-3200 • FAX (409) 588-4434



RADIO ENGINEERING PRODUCTS

SOFTWARE

- 3-D Terrain
- Coverage Predictions
- Fresnel Zone Studies
- Engineering Package
- Intermodulation Studies
- 3 or 30 Second Terrain Files

FCC INFORMATION

- Dial Access
- State Frequency Lists
- Custom Searches
- Mailing Labels
- Print-outs
- Data Files



C.E.T., INC.

1001 S. Ridgewood Ave.
Edgewater, FL 32132

Phone: 904-426-0014 • Fax: 904-426-0099

Circle (105) on Fast Fact Card

Pager repairs

BRAVO HAVE A BLACK EYE?
NO BEEP FROM YOUR BEEPER?
DIGITS MISSING FROM DIGITAL?

CALL PAGER COMMUNICATIONS

\$10 Flat Rate + Parts
Discounts for Quantities
Low Cost Conversions

Just Call

1-800-955-1044

Make your
classified
ad

STAND
OUT!

Use
COLOR!

Advanced RF Coverage and Propagation Software

Applied Spectrum Research

- * Radio Area Coverage
- * Path Profiles
- * Land Use/Vegetation
- * Easy to Use on Your PC
- * Full Range of Design Options
- * Single or Multi Site/Cellular
- * Digital Topography
- * Geographic Boundaries
- * International Applications

2975 Valmont # 100
Boulder, CO 80301 USA

(01) 303 444 4871
FAX: 303 444 4872

The SENTRY "Service Manager"

The technicians very own encyclopedia of service department information. A collection of over 50 Programs, Charts, Formulas and Conversion Factors. Information required daily, now on your service shop computer.

Faster than looking it up in a book..

Send \$ 79.95 Check or Money Order to:

SENTRY USA®

P.O. Box 372416

Indian Harbour Beach, FL 32937-0416

Telephone (407) 773-6090 FAX (407) 773-6092

Circle (106) on Fast Fact Card

Radio Propagation Software for PC's / WINDOWS

- LMR Predicted Area Coverage - Multi-Site Coverage Maps
- No Radial Generation Required - Real Time Propagation Study / Profiles
- DXF / HPGL Output - Direct Interface with AutoCAD, TurboCAD, etc.
- Multiple Propagation Models - Okumura, Field Strength, Shadow Maps
- VHF / UHF / Microwave Point-to-Point Path Profiles and Link Analysis
- 3 Second Digital Elevation Data on CD-ROM and Floppy Disk



Rocky Mountain Communications, Inc.

14200 W. 30th Avenue ■ Golden, Colorado 80401-1412

Tel: (303) 526-5454 Fax: 526-2662 BBS: 271-9670

SAVE TIME

For fast, accurate service, please remove the Peel-Off Label (which is used to address your magazine) and affix it to the Fast Fax Card, the Address Change Card, or to any correspondence you send us regarding your subscription.

RFCAD™

FOR WINDOWS IS HERE!

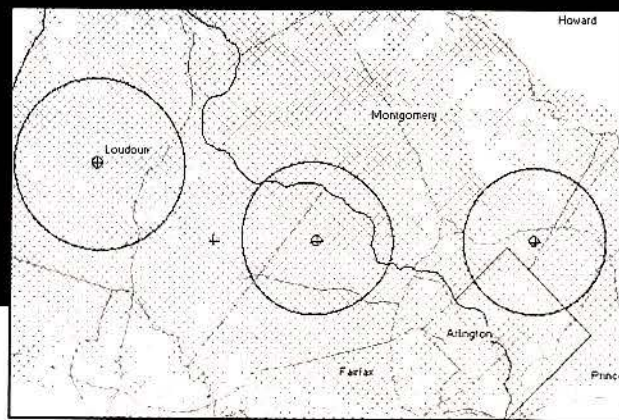
CDS has been the leader in high quality propagation analysis software and services for over twelve years - RFCAD™ is the keystone in our line of RF-Engineering Tools™.

For the most efficient, effective, and accurate Multiple Site Coverage Analysis PC software package in the industry, there is only one choice: RFCAD™.

In addition to the PC software package, CDS also offers UNIX based propagation packages, Online Remote Access Propagation Services, and an array of additional services and products. Please contact us today to request the latest catalog of services.



**Communications
Data Services, Inc.**



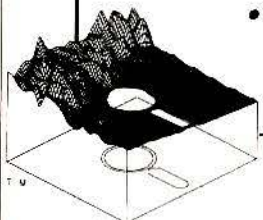
- ☐ Microsoft Windows Application
- ☐ Received Power Analysis
- ☐ Multiple site composite coverage (any number of sites)
- ☐ Land Use and Land Cover Data Base available
- ☐ Statistical analysis of model performance available
- ☐ Multiple, interchangeable propagation models to choose from (Bibby-C, Longley-Rice, CRC, etc.)
- ☐ 3 Second Terrain Data available on a single CD-ROM for US, Canada, and Mexico
- ☐ Field Data integration
- ☐ Demonstration disks available

6105-E Arlington Blvd.
Falls Church, VA 22044
(703) 534-0034 - (800) 441-0034

Circle (107) on Fast Fact Card

- **Straight Answers to Hard Questions**
- **Increase Your Productivity**
- **Understand the Mysteries of Radio Propagation Studies**

- Find out if your system will work before you construct it
- More than just rf software
 - Training • Education • Best product support in the industry
 - Annual User's Seminar • Product support provided by the authors of the software
- Save money by doing your own engineering
- Over 300 antenna patterns supplied in library
- Wide diversity of propagation models



SoftWright

Limited Liability Company
1010 South Joliet, Suite 204
Aurora, Colorado 80012
(303) 344-5486 • Fax (303) 344-2811
Tele TAP BBS (303) 344-5378

Circle (108) on Fast Fact Card

COMPUTER ENGINEERING OF MICROWAVE SYSTEMS (CEMS)

RADIO COVERAGE ENGINEERING SOFTWARE (RCES)

3 Second
Terrain Data

MICROWAVE

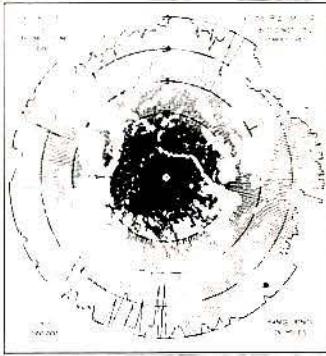
- Menu Driven - Color Coded
- On-Screen Path Profile Design
- Diffraction Loss Calculations
- Reflected Signal Analysis
- Route and System Diagrams
- Map Crossings - Graphic with Dimensions
- Performance Predictions: Analog, Digital and Video

LAND MOBILE RADIO

- Coverage Diagrams
- Multiple Prediction Models
- 360 Radials - 50 Mi (80 Km) Radius
- Relief Maps in Color
- Intermodulation Calculations
 - 300 Tx and Rx Frequencies
 - Up to 99th Order
- Graphic Presentations

NORTON ENGINEERING
10002 McDuff Court
Vienna, VA 22181
703) 938-5745
Fax: (703) 938-9168

Demo Disk
and
Sample Printouts
Available



Circle (109) on Fast Fact Card

AVAILABLE IMMEDIATELY

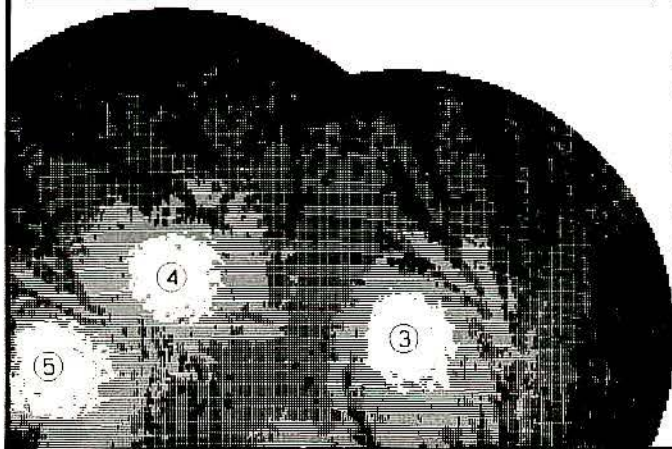
24,000+
Recruitment
Prospects With
Every Issue of

Mobile Radio Technology

Place your
recruitment
ad TODAY

Call or Fax
Joyce Bollegar
Today!
(913) 967-1923
Fax 913-967-1735

MULTI-SITE COVERAGE



MSITE™, our latest terrain-based propagation program, offers you multi-site composite analysis of field strength, received power, C/I ratio, most likely server, and basic shadowing for up to 50 transmitter sites. It's another example of EDX's leadership in communications engineering software tools.

- Propagation software - whether it's **MSITE**, or our newest product **MCS™** for microcell ray-tracing simulations, or our industry standard **SHDMP™** and **RPATH™** programs, for 8 years EDX has been the innovator in PC propagation software.
- Terrain data - EDX was the first company to offer the entire US 3" terrain database on a single CD-ROM.
- International presence - EDX has customers in more than 30 countries on 6 continents. From the borough of Manhattan to the Great Barrier Reef, the sun never sets on EDX software.

Send for our complete software catalog today.

EDX Engineering, Inc.

P.O. Box 1547, Eugene, Oregon U.S.A.
Tel: (503) 345-0019 Fax: (503) 345-8145

Circle (110) on Fast Fact Card

Classified

Computer software

CAPCODE1

by TNL Software, Ltd.



- ❖ The **1** and only software you'll ever need for pager inventory and account billing. Supports multiple capcodes, phone numbers and service plans per pager.
- ❖ Can bill some accounts in advance and others for arrears, even by different number of days in advance and with different "Due By" dates.
- ❖ Can use different rate plans (by pager), for example: retail, wholesale, corporate, etc.
- ❖ Runs under Microsoft Windows 3.11, easy to use graphical interface... no special training!
- ❖ Network-ready at no additional charge! Can run on any network or computer supported by Windows. Not a "Limited or Restricted Version".
- ❖ On-line, full-color graphs and reports.

- ❖ **CAPCODE1** has a capacity of one Billion (1,000,000,000) records!
- ❖ Your data is password secured and/or encrypted for protection from "hackers".
- ❖ Print reports and invoices on plain paper... on any printer supported by Windows 3.11, even in color!
- ❖ ~~\$1,395.00~~ Introductory Special... only \$795 for the first 300 orders placed... "Charter Customers" also receive free upgrades for the first three years.
- ❖ Can automatically "beep" delinquent customers to call you! (requires a modem.)
- ❖ Author has 15 years experience designing database systems and 20 years experience writing software!
- ❖ Now shipping! Due to tremendous response, special offer extended to first 500 orders! Call or write for information...

TNL Software, Ltd. Voice or FAX:
41 Sutter Street, Suite 1606 415-397-5557
San Francisco, California 94104 800-569-3288

Circle (111) on Fast Fact Card

The Service Processor Computerized Work Ticket, Automatic Inventory adjust, Auto Ticket Pricing, On line service history MA or T&M, MA records, Frequencies Cap Codes Etc. On line Help. Generate any Report. Easy to use. Character oriented, or mouse driven. Network and Windows ready.

DEMO, ACTUAL SOFTWARE, FREE
Midwest Data Service
P.O. Box 178, Philo, IL 61864
217-684-2641

Professional Consulting Services

Make your
classified ad
STAND OUT!
Use
COLOR!



FCC License Application Preparation and Technical Services

Application Preparation and Filing for Parts 90 and 94 Radio Services
MAS Frequency Selection and Coordination
Short-space System Negotiations
Contour Studies, both single site and multiple site

HAAT/DHAAT Calculations
Point-to-Point Path Profiles with Fresnel Zones
Intermod Interference Studies
Frequency Availability Searches
License Tracking and Renewal

Contact **Richard Doody, Director, Coordination and Licensing Services**

UTC Service Corporation

1140 Connecticut Avenue, NW Suite 1110 Washington, DC 20036 202/331-9495 FAX: 202/331-7639

Circle (113) on Fast Fact Card

COMMUNICATIONS CONSULTING SERVICES

- ❑ Mobile Radio Systems
- ❑ Mobile/Portable Data Systems
- ❑ Computer Aided Dispatch Systems
- ❑ Basic And Enhanced 9-1-1 Systems
- ❑ Telephone Networks
- ❑ Microwave Radio Systems
- ❑ Vehicle Location Systems
- ❑ Fiber Optic/PCM Transmission Systems

PLANNING, DESIGN, IMPLEMENTATION



10 Woodbridge Center Drive
Woodbridge, NJ 07095
(908) 636-6970
Toll-Free: (800) 247-4796 • FAX: (908) 636-7260

Offices throughout the United States and London, England, Melbourne, Australia, Richmond, B.C. Canada

Circle (112) on Fast Fact Card

Make your
classified
ad
STAND OUT!
Use
COLOR!

Rentals

MOTOROLA RENTALS

- GP300, P200, HT600
- Mobiles, Repeaters
- Intrinsically Safe
- Dealers Welcome

MOSS COMMUNICATIONS

1-800-822-MOSS

MOTOROLA RADIO RENTALS

- MT1000, HT600, P200
- Intrinsically Safe
- All Types Headphones
- Mobiles & Portapacks
- Repeaters & Crossband Sets
- Dealer Inquiries Invited

1-800-283-COMM
EVENT RENTAL COMM., INC.

Repair services

BENDIX / KING

Authorized Service Center
Repair Services for all your communications needs!

- FREE Estimates
- 90-Day Warranty
- Quick Turn-around
- FM / AM / SSB / CW
- Northwest Location

SKYLINE RADIO (503) 663-5858

MOTOROLA REPAIR SERVICE

Spectra	Syntor	Mostar	Motrac
Micor	Maxar	Maxtrac	Radius
Mitrac	HT600	HT50	HT10
MTX800	MTX810	MTX900	

Return Shipping Paid Under Five Pounds Per Radio

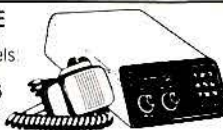
C.C.S. 310-670-0005

\$25.00 FLAT RATE

Plus Parts & Shipping

On the following models:

XLH-250	RH-250
RH-256	WH-2516
WH-2510	RFH-252
UC-102	UC-202
TRH-202	



REGENCY/WILSON

MULTICOM
2608 N. Moore Ave.
Moore, OK 73160-3316
405-799-7356 800-880-7356

- FAST TURNAROUND
- FACTORY TRAINED
- VISA - MASTERCARD - COD

ACS

"The Pager Repair People"

High quality, cost effective, and guaranteed pager repair. Flat rate labor (plus parts and shipping) on Motorola, NEC, Panasonic and Shinwa.

(303) 337-4811 FAX (303) 337-3084

Repair services

NS ELECTRONICS SERVICE INC.

COMMUNICATIONS MONITORS SALES & SERVICE
N.I.S.T. TRACEABLE CALIBRATION
CUSHMAN IFR
SALES NEW-USED

3610 Dekalb Technology Parkway
Suite 110/111
Atlanta, Georgia 30340
(404) 451-3264
Fax: (404) 458-8785

CALL

AUTHORIZED
CUSHMAN SERVICE

LOUDOUN COMMUNICATIONS, INC.

Communications Systems
REPAIR DEPOT

Microprocessor based Mobiles,
portables, controlheads.
GE Warranty Processing
Fast turn-around



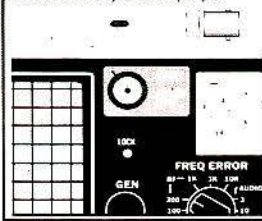
585 Factory Shoals Road
Austell, GA 30001

404/948-9566

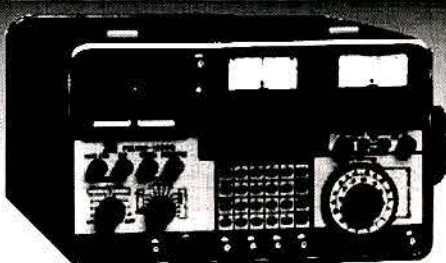
SERVICE MONITOR REPAIR/CALIBRATION

RF Fuse For IFR Monitors

- For models 500A, 1200A/S, 1500, A7500
- Just \$90 inc. freight and 2 spare fuses
- Costs less than your first repair job!



Specializing in Service Monitors since 1973 • NIST Traceable



WE BUY AND SELL USED MONITORS!

Phone (800) 288-8223 or (303) 962-9998

951 Des Moines Ave., Loveland, CO 80537



Circle (114) on Fast Fact Card

Tower space

38 CALIFORNIA ANTENNA SITES

- Major Locations • Stand-by power
- Secure facilities • Air Conditioning

Or develop your own site.
Land available at
Oat Mountain/Chatsworth.

MERIDIAN COMMUNICATIONS

Since 1956

20501 Park Sorrento, Ste. 213A
Calabasas, CA 91302-1355

Contact Rich or Jack Reichler at

800/400-SITE (7483)
818/888-7000



Triton Electronics, Inc.

SERVICE MONITOR REPAIR & CALIBRATION

Exclusive monitor repair since 1973

NIST TRACEABLE

Cushman, IFR, Motorola, Marconi

4300 Lincoln Ave., Unit O
Rolling Meadows, IL 60008
(708) 934-6426 Fax (708) 934-7195

**Make your
classified
ad
STAND
OUT!
Use
COLOR!**



STAN STANN

TEL: (708) 823-7713

CHICAGO TOWER
LEASING CORP.

COMMUNICATIONS
TOWER & ANTENNA
SITES FOR THE
METROPOLITAN CHICAGO
AREA

P.O. Box 31160
CHICAGO IL 60631

Tower space

TEXAS "PRIME" TOWER SITES

Dallas, Ft. Worth, Houston
System Installation - System Maintenance

Fleet Call of Texas, Inc.

Dallas (214) 330-5161 Jim Slagle
Houston (409) 756-8803 Robert Campbell



Subscribe and ye shall find

Fryer's Site Guide brings you information on over 50,000 antenna tower sites across the United States. Six regional volumes carry over 9,000 listings each with detailed area maps, phone contacts of site managers/owners, service industry contacts and more. Save time manpower and money by putting Fryer's Site Guide to work as your site location researcher.

NATIONAL SUBSCRIPTION : \$ 400
REGIONAL SUBSCRIPTION: \$ 75

• East • West • Southeast • Texas/Gulf • Mid-States • Plains
announcing: call: 215 660-7804

FRYER'S



a joint venture of CDS & Fryer's Site Guide

On-Line

an on-line
data base
available
only to
subscribers

Circle (115) on Fast Fact Card

Tower space

Tower Space Available

45 miles west of Washington, DC
Loudoun County, VA — Mount Weather
Lat. 39°05'05"N — Long. 77°51'38"W
1900 AMSL — Wide Area Coverage

28 miles west of Washington, DC
Lat. 38°54'23"N — Long. 77°40'20"W
1366 AMSL — Covers Western Areas of
Washington, DC Metro Area

28 miles northwest of Minneapolis, Minn.
Elk River, Minn.
Lat. 45°20'35" — Long. 93°34'18"
1325 AMSL — Wide Area Coverage

Contact: Ken Van Patten
Northwest Tower Service, Inc.
(703) 255-9781 Fax (703) 255-1292

RF RADIATION MEASUREMENTS

ANSI/IEEE - 1992

RAYMOND C. TROTT
CONSULTING ENGINEERS, INC.
1425 GREENWAY DRIVE, SUITE 350
IRVING, TEXAS 75038
214-580-1911

WESTERN WASHINGTON

Commercial power with generator backup.
Good security. Year around access.
Four Sites.

GOLDSPAR COMMUNICATIONS
Alan Robinson
206-475-9430 Fax 206-475-9410

ARIZONA'S PREMIER TOWER FACILITIES

Contact Dave or Charlie Bonifasi
ANTENNA SITES, INC.
602-998-7222

**Central New
Hampshire's
Finest Tower Facilities.**
Call Bill
(603) 524-2216

BADGER MOUNTAIN

SE Washington - Benton County
SITES AVAILABLE
N.L. 46° 14' 46" W.L. 119° 19' 31"
EL 1579 MSL

Badger Mountain Antennae, Inc.
(509) 582-3437

SET YOUR "SITES" ON US

WE can save you time and money. Call for a list of California's best kept secrets...805-945-5448.
If you don't we both lose money.

We've got you covered.

For superior antenna site coverage along with the Quality and Customer Service you expect from an industry leader - choose Motorola. Our nationwide network of antenna sites offers you space on thousands of premier antenna sites across the country. Contact Motorola Network Services Division today for your local and national site needs or to find out more about our site planning and management services.

U.S. Network Services Division,
Antenna Site Information
708-576-5484



© Motorola, 1991. ® and Motorola are trademarks of Motorola, Inc.

Circle (120) on Fast Fact Card

Make your
classified
ad

**STAND
OUT!**

Use
COLOR!

COMMUNICATIONS SITE SPECIALISTS.

- ✓ Site Selection, Acquisition, Development, Construction, Engineering, Management, Marketing.
- ✓ Sites Available Now... CA, CT, DC, FL, IL, IN, LA, MA, MD, MI, MO, NC, NJ, NM, NY, OH, PA, TX, UT, & VA

RAM

FACILITIES MANAGEMENT

2400 Ownby Lane, Richmond, VA 23220
(804) 353-4782 • Toll-Free (800) 438-3810
FAX: (804) 353-8059

10 Woodbridge Center Drive, Woodbridge, NJ 07095
FAX: (908) 536-7260 • Toll-Free (800) 247-4796

TOWER SPACE

Westchester • Putnam • Rockland
Connecticut

Combiners 70-960MHz Bogner and Antel antennas 450-960MHz with downtilt and null fill. Satellite earth station antenna available. Emergency generator, A/C. Elev. over 1,000 ft. Easy access all year. Covers Westchester, Putnam, Rockland and parts of Conn. Contact Jerry Agliata.

SIGNAL TOWER COMPANY, INC.
914-779-3676 • Fax 914-633-9315

NEED TENANTS??

Advertise your sites in the
**NATIONAL COMMUNICATIONS
SITE DIRECTORY**

Dedicated to advertising antenna sites for lease

NEED SITES?

The NCSD contains hundreds of prime antenna sites across the Nation.

To get your copy write or call:

INTRAFAAM, Dept. M, P.O. Box 6093
Freehold, NJ 07728 (908) 462-5964

PRIME NORTHERN NEVADA SITES

Our newest, Pond Peak, at 8035' AMSL, 2635' AAT, Emergency Power, Air Conditioning, Overlooking Reno, Fallon and the I-80 corridor,

702-825-2626

GREAT BASIN COMMUNICATIONS

John M. Rowe

Communications Real Estate
High Volume, Quality Controlled Site
Acquisition and Development



1236 Corona #2
Denver, CO 80218
(303) 830-0815

Tower Services

We've got Northern California



in our Sites

One call gets all the facts on how to cover the major population centers from more than 30 sites...with air conditioning, back-up power, remote monitoring, and much more.

DIABLO COMMUNICATIONS, INC.
1220 Brickyard Cove Road, Suite 200
Point Richmond, CA 94801
(510) 236-3700, Fax (510) 236-3799

Circle (117) on Fast Fact Card



TowerWatch

Tower Monitoring Systems

- FAA Reporting and Logging
(to meet FCC & FAA requirements)
- Lighting & Security Alarm Equipment
- Central Station Monitoring

1-800-475-1780

Dealer Inquiries Welcome

Circle (116) on Fast Fact Card

C TOWER SITE N S U L T A N T

Want more from your tower site?
Plagued by intermod problems?

Not enough room for more
antennas?

Trouble with existing leases?

Experienced communications tower site owner/operator and consultant can show you how to deal with site problems and increase your profits.

For a FREE initial consultation
call Jerry Agliata at
TRANSCOM CORPORATION
(914) 779-3676 or Fax: (914) 633-9315

USE MOBILE RADIO TECHNOLOGY CLASSIFIED ADS

CD-ROM

AAT Communications Corporation



ON TOP OF THE WORLD

AVAILABLE NOW!!!

BELLE MEAD/NESHANIC, NJ

LATITUDE: 40 27' 11"

LONGITUDE: 74 43' 42"

OVERALL HEIGHT: 730' AMSL

LAKE HOPATCONG/ROUTE 80, NJ

LATITUDE: 40 56' 25"

LONGITUDE: 74 36' 48"

OVERALL HEIGHT: 1,305' AMSL

PRINCETON/ROCKY HILL, NJ

LATITUDE: 40 24' 46"

LONGITUDE: 74 36' 07"

OVERALL HEIGHT: 508' AMSL

AAT Communications Corporation

30 Campus Plaza, Edison, NJ 08837-3911
For more information contact C. J. Manolescu
908-417-3993 • Fax 908-417-4825

Circle (118) on Fast Fact Card

For
Classified
information

Call

Joyce

Bollegar

(913) 967-1923

FCC MASTER FREQUENCY DATABASE CDROM

All frequencies within the FCC Master Frequency Database
for the entire US on CDROMS, Floppy Disk and Printouts

Dbase File Structure (ASCII Avail)

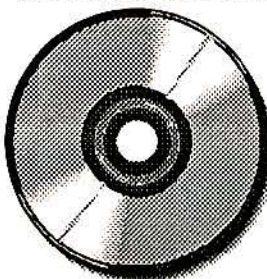
Exporting Available

Frequency, Callsign, DBA Name,
Licensee, City, State, Zip

Transmitter Lat & Long,
Elevation, Antenna Height
Address and County

Radio Service Code, Issue &
Expiration Dates and more

Custom Databases Available



Full Master Frequency Database Available on CDROM
Call for more information and pricing on our complete product line.
New Pricing!!! All CDs \$99.95. All State Floppy Disk \$35.00

PerCon Corporation CD Applications Division

Bemus Point, NY 14712

4906 Maple Springs / Ellery Road

(716) 386-6015 (716) 386-6013 FAX



Circle (119) on Fast Fact Card

A d index/hot line

Company	Page Number	Fast Fact Number	Advertiser Hotline	Company	Page Number	Fast Fact Number	Advertiser Hotline
AAT Communications Corp	79	118	908-417-3993	Mechem Electronics	64	81	703-373-3888
Advanced Receiver Research	32	28	203-582-9409	Megahertz Technology, Inc.	65	84	214-341-1119
Allen Telecom Group	IFC	1	800-229-4706	Meridian Comms-Comms Express	70	102	800-631-7297
Anchor Graphics	64	78	214-242-0439	Midian Electronics Inc.	35	30	800-MID-ANS
The Antenna Farm	71	120	800-255-6222	Modular Communication Systems	42	38	818-764-1333
Astron Corp.	23	20	714-458-7277	Monark International Corp.	16	14	816-891-0700
Automation & Electronics Engr.	70	101	800-527-4596	Motorola C & E	37,78	32,120	708-576-5484
Auto-Trac, Inc.	26	23	214-480-8145	Motorola Government	17	15	800-235-9590
Avtec Inc.	36	31	803-892-2181	MX-Com, Inc.	7	7	919-744-5050
BatteryPRO Centres Inc.	57	57	800-661-9401	New Mar	38,64	34,82	800-854-3906
BEE Electronics Inc.	44	40	708-345-0337	Norton Engineering	75	109	703-938-5745
Bramco Inc.	69	98	513-773-6255	Optoelectronics, Inc.	65	83	800-327-5912
CELWAVE	18-19	16	800-321-4700	Orbacom Systems Inc.	21	19	609-829-4455
Centurion International, Inc.	9	8	800-228-4563	Pacific Circuit Design	68	96	604-656-8849
C.E.T., Inc.	73	105	904-426-0014	Page Network, Inc.	61		
Chargeguard Corp.	67	92	800-458-3410	Palomar Telecomm, Inc.	65	85	619-746-7998
Cimarron Technologies	25	22	800-487-7184	Pekaar Communication, Inc.	72	103	201-772-0704
Combined Technologies Inc.	52	50	513-595-5900	Percon Corporation	79	119	716-386-6015
Communication Instruments	77	114	303-962-9998	Photocomm, Inc.	56	55	800-223-7975
Communications Associates	69	99	800-435-9313	Pipo Communications	66	86	916-644-5444
Communications Data Services	74	107	800-441-0034	Polaris Industries	67	90	800-752-3571
Communications Specialists	BC	3	800-854-0547	Procomm	62	73	805-497-2397
Connect Systems, Inc.	13	11	800-545-1349	Radio Central, Inc.	63	77	800-923-6872
Control Signal Corp.	20	17	303-989-8000	Radio Express, Inc.	63	74	703-266-1928
CPI Communications, Inc.	14	10	214-437-5320	The Radio Shop	66	88	713-526-8000
Cushcraft/Signals Corp.	15	13	800-258-3860	Ramsey Electronics	64	80	716-924-4560
Datacom, Inc.	52	51	217-222-0160	RCW Distributing	68	94	800-726-9015
Diablo Communications, Inc.	79	117	510-236-3700	Rocky Mountain Comms, Inc.	74		303-526-5454
D & L Communications Inc.	50,62	48,70	219-484-0466	Sante Fe Distributing	54	53	913-492-8288
D & L Communications Inc.	69,73	100,104	219-484-0466	Scala Electronic Corp.	59	60	503-779-6500
Doppler Systems, Inc.	57	56	602-488-9755	Schlumberger Technologies	11	9	800-225-5765
Dynatech Tactical Comms	38	33	603-880-4411	Selectone Corporation	3	5	800-227-0376
Eagle Wichita	48	45	316-265-2050	Sentry USA	74	106	407-773-6090
EDX Engineering Inc.	75	110	503-345-0019	Sharp Communication	68	95	800-548-2484
Entelec	49	47	214-235-0655	Shinwa Communications of Am.	30	26	800-627-4722
E Trunk Systems, Inc.	68	93	914-245-1128	Softwright	75	108	303-344-5486
Fryer's Site Guide	77	115	215-660-7804	Solar Electric Specialties	48	46	707-459-9496
Doug Hall Electronics	57	58	614-261-8871	Survey Technology	51	49	503-591-5986
Henry Radio	46	43	800-877-7979	Tait Electronics USA, Inc.	24	21	713-984-8684
Hewlett Packard	32A-B,33	29	509-921-4001	Telelink Technologies, Inc.	31	27	800-567-8884
Hustler, Inc.	27	24	800-949-9490	Telemessaging Devices Inc.	55	54	800-645-4595
Hutton Communications	12	10	800-442-3811	Telewave, Inc.	53	52	415-968-4400
Hy-Q International	69	97	606-283-5000	Telex Communications, Inc.	44	41	800-554-0716
IFR Systems, Inc.	29	25	316-522-4981	TNL Software	76	111	415-397-5557
Intertec Info Age Books	56		913-967-1856	Transcript International Ltd.	5		800-228-0226
JBRO Batteries, Inc.	41	37	800-323-3779	UTC Service Corp.	76	113	202-872-1268
Kirby Enterprises	63	76	513-542-3696	Vega, A Mark IV Company	1	4	818-442-0782
Larsen Electronics	43	39	800-426-1656	Versatel Communications	66	87	800-456-5548
Lazer Beepers, Inc.	64	79	800-354-3405	Vertex/Yaesu USA	IBC	2	310-404-2700
Link Communications, Inc.	66	89	406-587-4085	Vocom/RF Corporation	20	18	800-USA-MADE
Loudoun Communications, Inc.	66	89	406-587-4085	West Tennessee Comm's	62	71	800-249-1250
Marconi Instruments	39	35	800-233-2955	Zetron, Inc.	40,58	36,59	206-820-6363
McManus Communications	63	75	501-763-6250	Zetron, Inc.	62	72	206-820-6363

The Vertex Line. Complete and Competitive.

6 Channel
Economy Portable
Transceivers
FTH-2009 VHF, 134-174 MHz
FTH-7009 UHF, 450-470 MHz
Shown with optional FTT-6
DTMF Keypad.

15 Channel
Compact Portable
Transceivers
FTH-2008 VHF, 150-174 MHz
FTH-7008 UHF, 405-470 MHz



32 Channel
Heavy Duty Portable
Transceivers
VX-500 VHF, 134-174 MHz,
5 Watt; VX-500 UHF, (TBA)
Shown with optional FTT-7
DTMF Keypad.

32 Channel
Commercial Dual Band
VHF/UHF
Portable Two-Way Radios
FTH-2070 VHF, 150-174 MHz;
UHF, 409-490 MHz*
*with degradation.

FMA-2070
Mobile Adapter (Not shown.)

When communication is critical – switch to Vertex! For business, industry and public safety, Vertex VHF/UHF compact portables, complete 4, 12/24 and 99 channel mobiles and exclusive FTH-2070 Dual Band portable with MIL-STD-810 C/D and FCC Part 80 are designed for years of tough field service and priced to suit any budget.

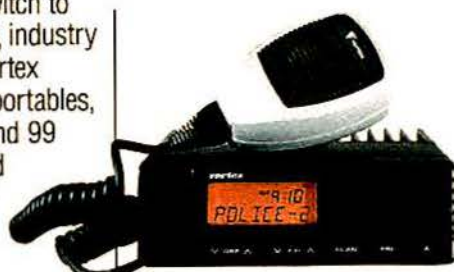


To make Vertex products even better, they're backed by a 3-Year Warranty on all products and Authorized Service Representatives are just a phone call away.



FP-711 Power Supply
(Base Station configuration shown.
Radio and MD-11A8J Desk Mic not
included.)

Specifications subject to change without notice.



99 Channel
Synthesized Wideband Mobile Radios



12/24 Channel
Synthesized Wideband Mobile Radios



4 Channel
Synthesized Wideband Mobile Radios

Frequencies

FTL-1011 Lowband:
37-48 MHz, 60 Watt
FTL-2011 VHF:
134-174 MHz, 40 Watt
FTL-7011 UHF:
400-512 MHz, 25 Watt



FT-80C HF SSB Transceiver
20 Channels, 1.8-30 MHz

Vertex commercial communication products have been recognized worldwide for over 4 decades for technical innovation and rugged reliability.



VHF/UHF Repeaters
VXR-5000 – RF Synthesized 136-174
MHz, 400-512 MHz, 25 Watt (shown.)
FTR-2410A, 136-174 MHz, 10 Watt
(RF); FTR-5410A, 430-512 MHz, 10
Watt (RF) (Not shown.)

So, put a "seasoned" pro to work communicating for you. Contact your Vertex dealer or call today for details – then switch to the Vertex Line. It's complete and competitive.



United States: Yaesu U.S.A.,
(310) 404-2700
Central & So. America:
Yaesu International Sales,
(305) 593-2500
Canada: Omni Provincial Electronics
(800) 567-6664

© 1993 Yaesu U.S.A.

Circle (2) on Fast Fact Card



ID-8 \$89.95
Automatic Morse Station Identifier. Meets all FCC ID Requirements. Fully field programmable with included keypad. 1.85" x 1.12" x .35"



CC-1/CR-1 \$49.95 each
Surface Mount Component Kits for repairing SMT circuits. CC-1 for capacitors/CR-1 for resistors.



TP-38 \$399.00
Shared Repeater Tone Panel. Full function, microprocessor controlled. 19.0" x 1.7" x 6.0"



TE-64 \$79.95
Self-contained Encoder, Rotary Dial Selection. Great for the Benchtop. 5.25" x 3.3" x 1.7"



TE-12P \$89.95
Self-contained CTCSS or Burst Encoder. Each dial position is field programmable. 5.25" x 3.3" x 1.7"



PE-1000 \$224.95
Desktop Paging Encoder. Two-tone sequential, other formats available. 7.5" x 7.8" x 2.7"



PE-2P \$54.95
Two-tone Sequential Encoder. Sub-assembly mounts inside radio or other enclosure. Multiple call capability. 1.25" x 2.0" x .4"



SD-1000 \$59.95
Two-tone Sequential Decoder. Programmable unit provides switched outputs from two-tone paging calls. 1.25" x 2.0" x .4"



DTD-1 \$59.95
Single Function DTMF Decoder. Provides switch outputs via DTMF. 1.25" x 2.0" x .4"



PE-4/PE-15 \$99.95
Multiple Call POCSAG (RPC-1) Paging Encoders. Where direct control of local area paging is desired. 1.78" x 1.03" x .35"



DCS-23 \$59.95
Digital Coded Squelch Encoder-Decoder. Programmable to all codes. 1.36" x 1.18" x .25"



TS-32P \$57.95
Programmable CTCSS Encoder-Decoder. Tone squelch for any FM transceiver. 1.25" x 2.0" x .4"



TS-64 \$64.95
Sub-miniature Programmable CTCSS Encoder-Decoder. 1.7" x .78" x .25"



SS-32SMP \$27.95
Sub-miniature CTCSS Encoder. Jumper programmable. .53" x 1.0" x .16"



SS-32PA \$28.95
Programmable CTCSS Encoder. Custom tones or audible tones also available. .9" x 1.3" x .4"

The Sky's The Limit!

For over 25 years... bringing you tone signalling products that are as reliable as the day is long. Combine this with same-day shipping, toll-free technical support, and our no hassle one year warranty, and you'll realize the

sky's the limit in our efforts toward customer satisfaction.

Shown are a few of our most popular tone signalling

products. Call for details on these and all your tone signalling needs. A free catalog will be mailed upon request.



COMMUNICATIONS SPECIALISTS, INC.
426 WEST TAFT AVENUE • ORANGE, CA 92665-4296
LOCAL (714) 998-3021 • FAX (714) 974-3420
ENTIRE U.S.A. 1-800-854-0547 • FAX 1-800-424-3420

